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SCIENTIFIC AMERICAN

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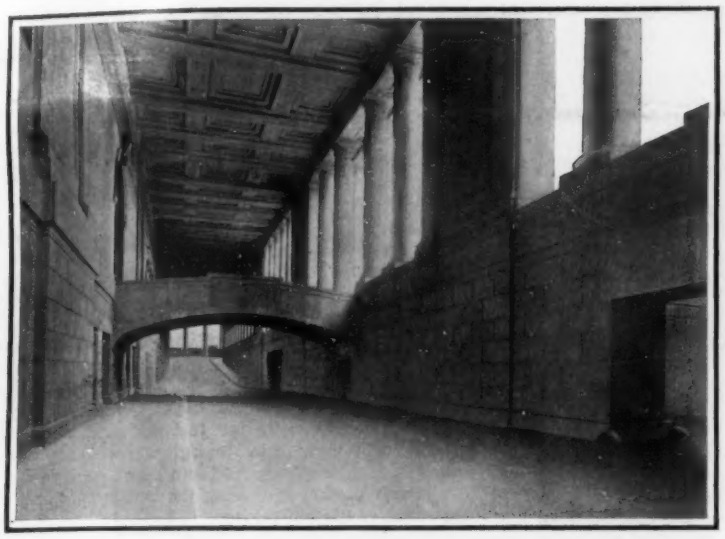
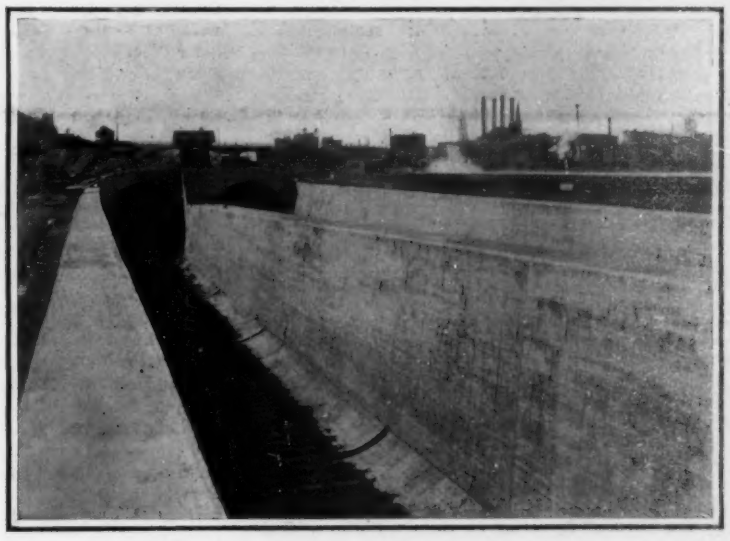
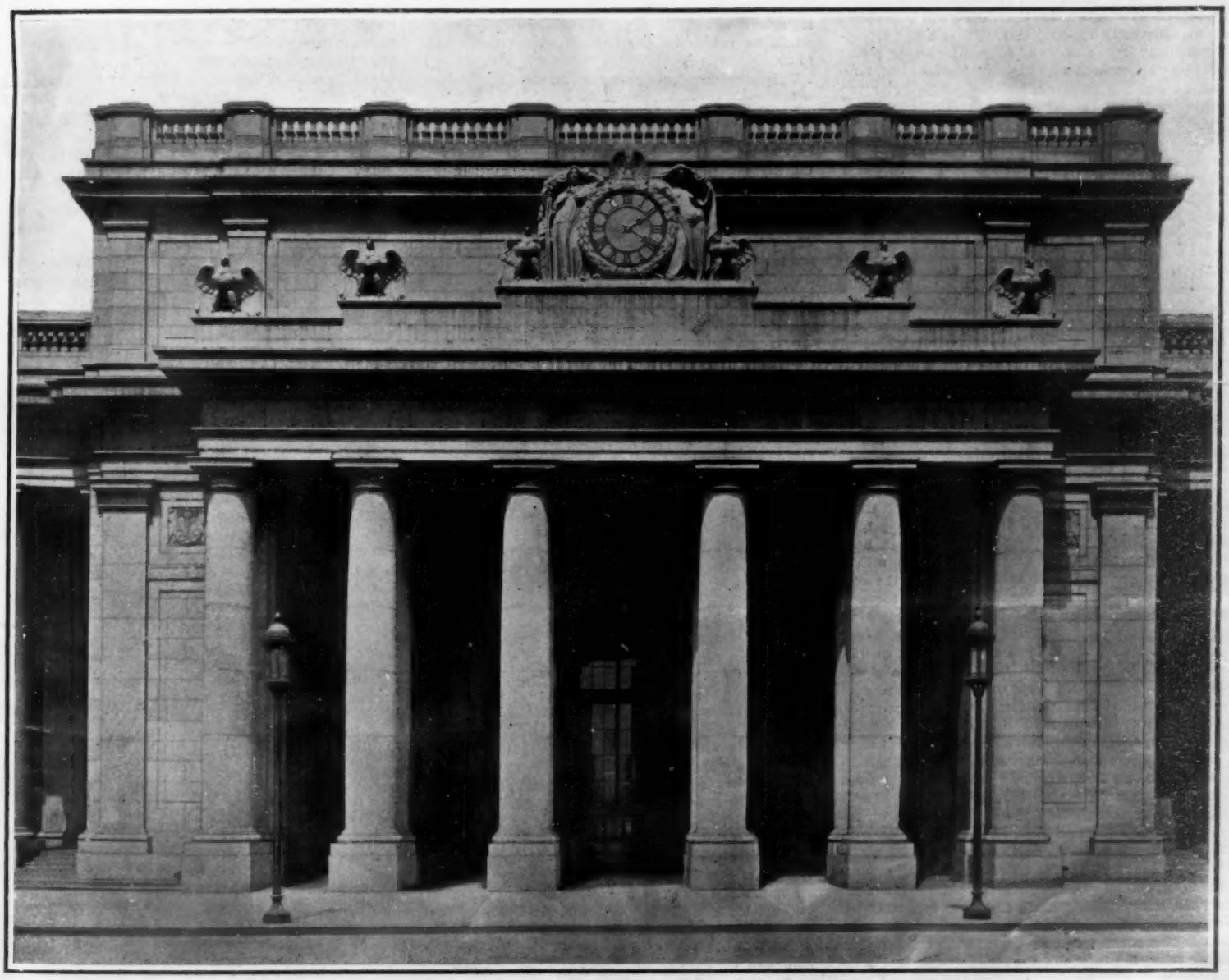


Driveway from street to first level, showing overhead bridge leading from street directly to waiting room.



The entrance to East River tunnels from Sunnyside yard, Long Island.



The exterior of the station, built after the Roman Doric style, is entirely of Milford granite. The columns are 4½ feet in diameter and 85 feet high.

The Impressive Main Entrance to the New Pennsylvania Railroad Station.

OPENING OF THE PENNSYLVANIA RAILROAD TERMINAL AND TUNNELS, NEW YORK.—[See page 200.]

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ESTABLISHED 1845

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NEW YORK, SATURDAY, SEPTEMBER 10th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PROGRESS WITH THE PRODUCER-GAS MARINE ENGINE.

THE belief that the producer-gas engine is to play an important part in the propulsion of vessels is strengthened by the good results which have been obtained in Germany, where excellent work has been done by the producer-gas tug "Deutz," operating on the river Rhine. This little craft is by no means the first of her type, for as far back as 1901 the Otto firm made their first experiment with a producer-gas engine for propelling boats, and several canal boats, some of which were made the subject of illustration in the SCIENTIFIC AMERICAN, were subsequently equipped and tried with this type of engine. The large amount of space which such plants occupied, as compared with gasoline engines, told, however, against the popularity of these and similar vessels equipped by other firms.

The appearance of the double-fire type of producer, in which all the volatile matter in the fuel must pass through the upper fire zone, where it is freed of tar before it reaches the gas outlet, made it possible to utilize brown-coal briquettes, a fuel which can be obtained at low cost anywhere on the Rhine; and it was found, on comparison, that it would be possible to construct a large steam tug, carrying this type of producer, which would show a decided commercial superiority over one equipped with a steam engine. Accordingly the "Deutz," which is 112 feet in length, was furnished by the Otto firm with a twin, 500 horse-power gas-engine plant, the whole of which is accommodated in a space measuring 20 feet by 42 feet. The total weight of the plant in pounds per indicated horse-power is 389, whereas the weight of a triple-expansion, 500 horse-power steam engine would be 496 pounds per indicated horse-power, the gas-engine plant being, therefore, 20 per cent lighter than a steam-engine plant of equal power. On the other hand, the cost of the gas-engine plant is about 10 per cent greater. During the first three months of its service, the "Deutz" made twelve round trips on the Rhine, representing 1,200 hours of towing. It averaged 3⅛ miles per hour against the current, towing two loaded boats with a total paying cargo of 3,200 tons. Including the coal used by the auxiliaries and during layover, the consumption averaged 550 pounds of lignite briquettes per hour; and the fuel cost for the round trip, which occupied a little over 100 hours, worked out at $55. Comparing this performance with that of a steam plant at the same rated horse-power, it is found that while the producer-gas plant can carry an overload, this is done at the expense of fuel economy. But the steam plant, when driven beyond its rating, will show a greatly increased consumption of fuel, and this in spite of the fact that the consumption for equal work is at all times much greater than that of the producer-plant. For further particulars of this installation, reference is made to an illustrated article published in the current issue of the SUPPLEMENT.

It is evident that the future of the producer-gas engine is a question of developing a producer which can take the ordinary bituminous fuels and deliver to the engine a gas that is free from tar. When, like the boilers of a steam plant, it can take the ordinary run of the mine, the future of the producer-gas engine for marine work will be assured; for the many advantages in its favor in the way of economy of space, weight, fuel and attendance are certain to assure its wide popularity.

PROF. KAPTEYN AND THE MOUNT WILSON REFLECTOR.

THE powerful 60-inch reflecting telescope of the Mount Wilson Solar Observatory of the Carnegie Institution of Washington has made possible the study of nebulæ and star clusters on a more satisfactory basis. Many of these nebulæ and star clusters have been photographed successfully, and in all cases the plates show an enormous amount of detail hitherto unrecorded.

Used photographically, this great telescope is peculiarly adapted for a most important investigation which has been in progress at Mount Wilson for some months, and which deals with the question of the absorption of the light from the stars by an intervening medium. This interesting work is being undertaken by Prof. J. C. Kapteyn of the University of Groningen in Holland, who spends each year several weeks at Mount Wilson as a research associate of the Solar Observatory. Such an arrangement is a peculiar characteristic and noteworthy feature of the Mount Wilson Observatory, whereby distinguished men of science connected with other institutions become associated with Prof. Hale and his colleagues for the investigation of problems in which they themselves are specially interested, and which at the same time stand in intimate relation to the work of the Solar Observatory. Prof. Kapteyn is one of the foremost authorities upon questions relating to the distribution of the stars throughout space and to the structure of the stellar universe.

In all such investigations the question as to the possible existence of an absorbing medium capable of reducing in intensity the light coming from the stars is most important. If there be an appreciable loss of light in transmission through space, the conclusions concerning the luminosity and distribution of the stars will be quite different from what they would be were there no such absorption. The problem is one of extreme difficulty, but Prof. Kapteyn has presented at various times evidences indicating that such an absorption exists. It may be remarked that such an absorption would affect the blue and violet rays more strongly than the red and orange, and be the more effective the greater the distance traversed by the light. The result, therefore, is that the more distant stars, synonymous in general with the fainter stars, would be redder on the average than those nearer to us.

This statement suggests the method of attack, which, in a word, consists in determining whether the fainter stars, the globular star clusters, and certain nebulæ—the clusters and nebulæ are known to be enormously distant—are redder than nearer objects of the same intrinsic color; that is, redder than nearer objects which present the same grouping of spectral lines. In the hope of securing a definite answer to this interesting problem, Prof. Kapteyn has proposed methods of investigation for which the great 60-inch reflector is peculiarly adapted. The observational evidence thus far obtained is confirmatory of the theory, but it is not yet decisive.

CAN GUN EROSION BE CHECKED?

WE doubt if there is any product of the foundry and machine shop which embodies more thorough expert investigation, more carefully selected material, and a higher class of workmanship, than the modern, high-power gun. In its completed condition, a 12-inch rifle costs a thousand dollars per ton, which represents a total cost for the gun, without its mounting, of from $50,000 to $60,000. Broadly speaking, the life of any mechanical product should be proportional to the excellence of its design, material, and workmanship; yet, it is a fact, that from the moment the first shot is fired from such a 12-inch piece, a depreciation in accuracy sets in, which is so rapid that by the time 100 rounds or less have been fired, the costly weapon is useless.

The loss of accuracy is due to the rapid wearing away of the rifling and the consequent failure of the projectile to "bite," and receive that high speed of rotation of several thousand turns per minute, which is necessary to maintain it during flight in the true end-on position. Erosion has increased in severity proportionately to the increase in powder pressure; and among the many theories which have been advanced by artillerists to explain this phenomenon, it has come to be pretty generally accepted that the wearing down of the bore is due to the terrific heat of the powder gases fusing a fine film of the surface of the bore, which is wiped away by the rush of the gases as they escape from the gun.

For many years the SCIENTIFIC AMERICAN has urged that erosion was due to the rush of the white-hot gases past the base of the shell, their escape being due to imperfect closing of openings between the shell and the bore, and we have believed that if some means could be found to remedy this, erosion would be largely, if not altogether, eliminated.

We have before us an excellent essay by Lieut. Commander H. E. Yarnell of the United States navy, dealing with gun erosion, in which an analysis is given of the latest experimental work done by the Bethlehem Steel Company, and at the Naval Proving Ground. Incorporated in the essay is a translation of a profound study of the subject by M. Vieille. This distinguished Frenchman states that the effects of erosion are similar to those which occur when a jet of air is directed on a film of water resting on a hard surface. A thin layer of metal is fused, or partially so, by the heat of the gases, and is then roughened up or entirely blown away by the fine streams of gas which escape past the driving band of the shell at an enormous pressure and velocity. This theory, of which the most earnest and practically the sole advocate in this country ten or twelve years ago was Mr. Brown, of the Brown wire gun, is now generally accepted, and the cause being known, it is now possible to make intelligent search for a remedy.

To prevent erosion, then, three conditions are necessary. First, metal for the inner tube with a high melting point; second, a powder whose gases will have a low temperature; and third, some device for completely closing the base of the shell as the projectile passes down the bore. With these three objects attained, there is no question that heavy scoring would be eliminated, and the life of the gun very greatly prolonged.

In their investigation of the subject, the Bethlehem company took a 12-inch shell, and inserted a plug through which the gases were allowed to escape, and the erosion on plugs of different kinds of steel carefully noted. The experiment showed, that, contrary to the popular impression, it is not the hard, but the mild or pure steels that best resist erosion. The Bethlehem experiments showed that even chrome and tungsten steel, in spite of the fact that they maintain their hardness at very high temperatures, resist erosion no better than the ordinary mild gun steel; nor can erosion be prevented by increasing the carbon or nickel in the metal of the inner tube.

In the experiments designed to reduce the temperature of the gases, there was placed inside the shell with the powder some materials designed to absorb a portion of the heat. Water was placed there, inclosed in a can, and paraffine wax, either in powder or in cakes, was tried. These materials, especially the water, materially reduced the erosion, the water in some cases by as much as 300 per cent, though strange to say, in some of the tests, but little of the water was evaporated, and the paraffine, at an enormously high temperature, was only partially melted. The wax, however, would seem to have some sealing effect on the base of the projectile, for it is found that erosion may be reduced by smearing the shells with a heavy grease.

The problem, then, would seem to be one calling for the combined efforts of the chemist, the metallurgist, and the mechanical engineer. It is for the chemist to produce a powder which will remain stable and undergo no chemical deterioration under the most trying conditions of climate and storage, that will be smokeless, and that, above all, will give the highest ballistic results with the smallest rise in temperature. It is for the metallurgist to produce a steel which will combine, with all the well-tried properties of our present mild gun steel, the ability to endure temperatures as high as 1,500 Centigrade. Lastly, it is for the mechanical engineer to find some effective device, which, acted upon by the pressure of the powder gases, will effectively close those small vents which at present occur between the rotating band and the rifling, and chiefly during the early part of the travel through the gun. Of the three desiderata, we believe the last-named to be by far the most important; and being a simple mechanical problem, it should be easiest of accomplishment. In the whole range of mechanical work, we can think of but few lines of investigation which would bring more immediate distinction and profit to the inventor than this.

Tests of the weathering of coal, to determine the loss in heat value by exposure, have been made by Prof. S. W. Parr and Mr. W. F. Wheeler at the engineering experiment station of the University of Illinois. The tests are described in Bulletin No. 38, just issued by the station. The authors review the researches of various experimenters who give percentages of loss due to weathering running up as high as 25 per cent. This is contradicted by other experimenters who find very little loss. The tests made by Messrs. Parr and Wheeler indicate that Illinois coal suffers very little loss in calorific power by storage, amounting probably to not over 3½ per cent as a maximum for coal stored a year. The chief damage which the coal suffers from storage is in the breakage, so that an undue percentage of dust and fine particles is formed. This, of course, does not include losses which may occur due to fires caused by spontaneous combustion. Such fires, and the breaking up of the coal into small particles, appear to be the chief objections to the storage of large quantities of coal for a long time.

ENGINEERING.

The torpedo boat destroyer "Paulding," which is one of the first vessels of this type to burn oil exclusively, has proved to be far faster than the contract requires. She has made over 33 knots during her standardization tests, although the government called for but 28 knots. The "Paulding" is a vessel of 289 feet length and 26 feet 1½ inches beam. On her mean draft she draws 8 feet 4 inches and displaces 742 tons.

The Army and Navy Journal quotes an officer of the Signal Corps as saying that if the aeroplane had been invented before the civil war, there would have been no "Sheridan's ride"; for an aeroplane would have landed him on the battlefield of Winchester in less than twenty minutes. He believes, moreover, that at Santiago the question of the whereabouts of the Spanish fleet would have been settled in a few minutes by sending a man up in an aeroplane who, with a field glass, could easily have located Admiral Cervera's ships.

In a recent letter to Mayor Gaynor, Mr. A. H. Holmes of this city has suggested, as a means for renewing the air of the subway and reducing the temperature, the construction, near the roof angle of the tunnel, of a series of long and narrow vents ending in grated openings on the street side of the sidewalks. Several years ago, large vent chambers provided with automatically opening and closing louvres were installed on a stretch of several miles of the subway, between Forty-second Street and Brooklyn Bridge Station, with a resulting improvement in the air and temperature. We believe that the system should be extended, both in the present and future subways, and that proportionately improved conditions would result.

Some years ago, in a paper before the Institution of Naval Architects of Great Britain, Mr. A. C. Holzapfel stated that the best method for insuring the protection of new steel vessels was to launch them without paint, and to apply a composition only after the vessel had been in the water for a month or two, and the mill scale had worn off. The steel training ship "Exmouth," which was built five years ago, received no paint whatever before she was launched, and after a month or two, she was put in drydock and given four coats of first-class paint. After being five years afloat, the bottom was found to be in a perfect state of preservation, with very little rust at the water line, and only a little grass and slime covering the anti-fouling composition, which was found to be in a thoroughly sound state of preservation.

We recently drew attention to the need for more careful design of the supports and bracing of roof tanks and display signs; and in this connection we note that a contemporary dwells at some length on the fact that tanks are frequently set on two I-beams which are not provided with the necessary lateral bracing between them. Thus, unbraced beams 35 feet long with a 7-inch top flange would have a ratio between the unsupported length and the width of the flange of 60, in which case the safe unit stress in the flange would be only one-half the safe stress if the beams were properly braced. All beams should be so connected by lateral bracing that the ratio of the width of flange to the unsupported length of beam would not exceed 20.

Experiments are to be undertaken at both the Atlantic and Pacific ends of the Panama Canal to determine the effect, if any, of sea water on the concrete of the lowest locks at Gatun and Miraflores. The tests will determine if it is necessary to place any special protection on the concrete. Slabs of concrete will be allowed to remain in the water for many months. Some of them will be left in their natural state. Some will be treated with sodium silicate in the form of soluble glass, solutions of different strength being used. Other slabs will be treated with alum and soap; three-quarters of a pound of soap in one gallon of water being applied, boiling hot, for the first wash, the second wash, applied 24 hours later, consisting of a solution of alum, two ounces to the gallon, applied cold.

The principle of the Heilman electric locomotive, which was tried in France in 1894, is to be given a more complete test in the Reid-Ramsay turbine-electric locomotive, which has been built in Scotland. The boiler supplies steam to a turbine running at 3,000 revolutions per minute, and directly coupled to a dynamo, which furnishes 200 and 600-volt current to motors on the driving axles of the locomotive. The exhaust steam is condensed, and returned to the boiler by means of a feed pump, the hot circulating water being cooled by a radiator placed in front of the locomotive. The object aimed at with this engine is to obtain the advantages of electric traction without the heavy expenditure of capital involved in electrifying the whole line. Practical railroad men will ask whether this costly locomotive can compete to advantage with the highly developed, efficient, and low-cost steam locomotive.

ELECTRICITY.

On the 28th of April, next year, the railroads of Russia will pass under the control of the Imperial Russian Technical Society. This day also marks the opening of an international exposition in St. Petersburg devoted particularly to the application of electricity to railroad service.

A novel lightning arrester for telegraph and telephone train dispatching circuits has recently been devised. In place of using an air gap, a block of carborundum is employed, which furnishes enough resistance to prevent leakage of the current under normal conditions, but allows charges induced by lightning to pass freely to the ground. These lightning arresters have been found to prevent the clicks commonly produced by static charges.

Experiments have been made by Prof. A. Garbasso to determine the efficiency of radiation of an inclined antenna. In a report recenlty submitted to the Academia dei Lincei, he states that the radiation is not uniform from an inclined antenna, but is greatest in the vertical plane of the antenna, and weakest at right angles thereto. He states that if the inclination is 45 deg., the energy is twice as great in the vertical plane in which the antenna lies as in a direction at right angles thereto.

The dam which the United States government is planning to construct at Troy across the Hudson River will wipe out a number of factories and mills in that region using water power. The head furnished by the dam will be utilized to generate about 6,000 horse-power, and this will be sold to the mills and factories at cost. However, the companies will be required to pay the cost of building the power house. It is estimated that the amount of power utilized will be three times as much as has heretofore been employed.

At first thought, one might be inclined to consider it incongruous to use an electrical vehicle as a hearse, but as a matter of fact the electrical hearse, moving with stately silence, is really more dignified than one drawn by horses. Such a hearse was recently constructed for a Chicago firm, and has been in continuous service ever since. Power is communicated from the motor to the rear wheels by means of silent chain drive. The battery is supported under the main body of the vehicle in a compartment between the front and rear wheels, and is adapted to furnish sufficient current to propel the hearse for a distance of fifty miles.

A draftsman seldom has the patience to erase an ink line from tracing cloth properly. If the eraser is operated with too much pressure, the cloth is marred. The proper method is to operate the eraser with a light but quick motion. Recently, an electrically-driven eraser has been invented, consisting of a small motor provided with a flexible shaft which carries a circular eraser at its outer end. In order to clean the eraser of particles of ink which it picks up, a cleaning rubber is provided, which bears lightly against the erasing rubber. A device of this sort should be sufficient to meet the requirements of a large drafting room.

The Washington Street tunnel in Chicago is being enlarged to make room for the wider street cars now in use. Lying directly against one wall of the old tunnel was a conduit of the Commonwealth Edison Company, which consisted of a large concrete-lined iron pipe. At first it was thought necessary to abandon this conduit and build another. On further consideration, however, it was decided to attempt to move the conduit intact. This was successfully accomplished by means of a large number of jacks. The entire length moved was 370 feet, and it was shifted three feet at one end and nine feet at the other. The work was done without cracking the concrete lining. In order to preserve the alignment of the conduit, blocks were erected vertically upon it at frequent intervals, and a man stationed at the end of the line, sighting along these blocks, was able to determine whether any of the jacks were being operated too rapidly.

The cities of Leeds and Bradford, England, have recenly made applications to Parliament to install trackless extensions to their present trolley systems. A committee was appointed by the city of Bradford to investigate the systems used on the Continent as well as an English system. The committee seemed to be most favorably impressed with the system used in Italy, which employs two overhead wires with a current collector, similar to that of the common trolley, bearing against the under side of the wires. This was considered an improvement over those systems in which the trolley bears on the top of the wire, for the reason that the latter requires a special overhead construction, and loops must be used at the ends of the line to permit the cars to turn around. In Italy trackless trolley cars are used to extend the track systems, and the cars may use the tracks and overhead wires on the regular trolley system, when it is necessary to run them to the shops for repairs.

AERONAUTICS.

M. Legagneux was seriously hurt at Havre on August 27th while competing for a total distance prize. His machine struck a post, fell to the ground, and buried him under it. Legagneux's skull was fractured.

A Dutch aeronaut, Van Masdyk, while attempting a cross-country flight near Arnheim, Netherlands, on August 27th, came to a violent end. The motor of the aeroplane suddenly stopped, and the machine fell to the ground.

Recently, when three French naval lieutenants were required to take a course at the Buc Military Aviation School, no fewer than 109 candidates came forward, a sufficient proof of the interest taken in aviation by the French navy.

The Italian aviator Bielovucci, on August 29th and 30th, made some daring flights over Paris. On the 29th he circled twice above the Eiffel tower at a height of some 2,500 feet, while the following day he maneuvered above the city for 40 minutes at a height of from 1,500 to 2,000 feet.

The first entry for the elimination race for the Gordon Bennett international trophy, at present held by Glenn Curtiss, was received on August 30th by the contest committee of the international aviation contest. The entry was received from Harry Harkness, son of the Standard Oil magnate. Mr. Harkness is the owner of two Antoinette machines.

Glenn H. Curtiss, on August 31st, flew from Euclid Beach, near Cleveland, to Cedar Point, a distance of 70 miles, without stopping. The start was made at 1:06. Curtiss alighted at 2:24. The flight is comparable with Curtiss' Hudson River achievement. The course followed a zigzag line along a shore fringed with cliffs and woods, so that alighting was difficult, and counter-currents and eddies numerous. The return trip, which was planned, had to be postponed on account of the high wind. Curtiss flew back on September 1st in the teeth of a high wind, making the distance in 1 hour and 42 minutes, and outstripping express train and homing pigeons.

Morane, the celebrated French aviator, who holds the record for speed made at the Rheims meet, on the 29th ultimo is reported to have broken Mr. J. Armstrong Drexel's height record of 6,752 feet. Both aviators used Blériot monoplanes. The new record is 2,150 meters or 7,054 feet. Morane has cabled his entry at the Harvard-Boston aviation meet, and it is expected that he will take part in this first great demonstration of flight in New England. He will be accompanied by Aubrun (who finished second in the 485-mile circuit of the East) and by a third aviator, M. Simon.

A number of excellent flights above water were made last week, both abroad and in our own country. On Sunday, August 28th, Armand Dufaux won the Swiss Aviation Club's prize for a flight across Lake Geneva. He started from Neville, four miles south of Montreux, and flew to Collonges, near Geneva—a total distance of about 40 miles—in 56 minutes. On Tuesday, August 30th, at the aviation meet of Havre, France, MM. Aubrun, Morane and Le Blanc on Blériot monoplanes, and Hubert Latham on his Antoinette monoplane flew across the mouth of the Seine to Trouville—a distance of 12 miles. Latham made the trip three times without landing. The next day Morane and Le Blanc again flew to Trouville for luncheon. On the return they passed in the air and saluted Latham and Thomas.

To James McCurdy belongs the distinction of having first communicated by wireless from an aeroplane with a land station. On August 27th he sent the following message: Over Barren Island, 6:54 P. M.

H. M. Horton: Another chapter in aerial achievement is recorded in the sending of this wireless message from an aeroplane in flight. McCURDY.

Horton was the wireless operator on the roof of the Sheepshead Bay race-track grand stand. Horton had rigged up an ingenious sending apparatus, which was affixed to the steering wheel of an aeroplane. The energy was derived from a vest-pocket battery. The aerial was fifty feet of wire held straight by a lead weight, the whole trailing after the machine.

The International Aviation Meet, which is to take place at Belmont Park, will be managed by Allen A. Ryan. Word has been received by Chairman J. C. McCoy, of the Commission on Sports, that Count Alesander Kalowrat and Baron Economo, vice president of the Vienna Aero Club, will compete in the different events. They will use a Voisin biplane and an Etrich-Wel monoplane. They will be accompanied by Prince Don Jaime de Bourbon, the pretender to the throne of Spain; Duke Franz Joseph de Braganza, Count Draskovitch, and Count Telika, of Budapest. The party will leave the first week in October. Both Count Kalowrat and Baron Economo are well known in European aviation circles and have made a number of successful flights.

THE ESPERANZA STONE.

BY CHARLES FREDERICK HOLDER.

Many years ago a strange stone resembling a meteorite fell into the valley of the Yaqui, Mexico, and the sensational story went from one end to the other of the country that a stone bearing human inscriptions had descended to the earth.

INSCRIPTION FACE OF ESPERANZA STONE.

Pieces of pottery lie near in the soil.

Hundreds visited the place, natives made a pilgrimage to it from all over Sonora, and the stone, called the Esperanza, became famous in its way, and many of the inhabitants believe that it is a message from heaven, and demand that it be translated.

The stone was found by Major Frederick Burnham, of the British army, the famous scout of the Boer war, and not long after he invited the writer to visit it, and endeavor, if possible, to decipher its story.

We left Los Angeles in April, and in a day and a half reached Noales. A day's trip took us down the great valley to our headquarters, the fine adobe of the Rio Yaqui Rod and Gun Club, located at Esperanza.

We started out with a Yaqui driver to hunt for the stone the following day, going south or east of Esperanza. Major Burnham had no marks, yet he located it with ease, and I soon found him standing by the alleged meteorite. In all the delta, three thousand square miles of which I rode over, in various directions, I did not see a stone or rock of any kind, hence the sudden view was striking of a big black pseudo-volcanic rock standing buried to half its size in the sand.

Major Burnham had his Yaquis dig out the dirt about the stone, so that it was easy to examine it. It impressed me as an ancient find. The soil line half way up was very distinct, and it had the mellowing tint, the rounding of the edges, that could only come in a long time.

The stone was a brown igneous rock, its longest axis being about eight feet, and on the eastern face, which had an angle of about forty-five degrees, was the deep-cut inscription, and as I glanced at it, the Mayan Codex flashed into my eyes, as I recognized some of the familiar symbols of this ancient record of Yucatan which has puzzled the wise men for years.

We had taken some flour paste with us, and outlined roughly the deep marks for the photographer, but omitted several of importance. The location was a singular one, being five or six miles from the Rio Yaqui and on what was doubtless the highway from south to north. In the soil thrown up by the men I found a number of pieces of pottery, parts of broken ollas, suggesting that those who had made the inscription, cutting it deep in the stone, must have brought water in them from the Yaqui, as the work with stone implements must have taken days or weeks. What the inscription means is of great interest. Major Burnham, who discovered the remarkable gold ornaments in a granite ruin of a remote civilization in Rhodesia, Africa, and explored that continent and Mexico, agreed with me as to the Maya suggestiveness; and I can only submit my own deductions, with the hope that they may aid some professional ethnologist in solving the riddle. I assumed the hypothesis that as there had been a high civilization in Yucatan and Guatemala in the past, shown by the writings and antiquities of the Mayans and later Mexicans, such a people must have been dominated by the spirit of exploration to the north; and as the stone is on a natural line of march from the south to the north, I assume that this is a record or report of some ancient people, probably Mayas, telling to the world and those who might come after, that they had reached the big river which to-day bears a similar name, the Maya and the Yaqui. They doubtless chiseled on the rock a picture of one or two of their many gods, the time of arrival, and some emblem indicating who they were.

Over this delta hundreds of expeditions have passed in the last thousand years, migratory bands, the ancestors of the Pueblos and others, and in the sixteenth century began the Spanish invasion of what is now New Mexico and Arizona, the search for the so-called "seven cities." Among the first was that of Nuno Guzeman, who, while Cortez was in Spain, organized an expedition for the exploration of the countries to the north.

In 1538, two friars reached the Gila. Many expeditions followed. All crossed a portion of the very heart of the forest of the Rio Yaqui, and among the legends and folklore of the natives of to-day are suggestions and memories of the gallant men, mounted on strange animals, bedecked in armor, who, pressing north, passed unknown the richest mines in the world in their search for gold.

Old Yaquis living in the Bacatete Mountains to-day have a legend that among the wild hordes who came up from the south were some who "cut signs on rocks," who left a message of discovery, or arrival, a notice possibly of water in abundance, a rich land, or a consecration to the gods, a legend interesting in connection with the inscription.

Assuming that the stone carvings are of Mayan origin, what is the evidence? The inscription faces the east; the strange figure on the left is perhaps one of the many gods, and is characteristic of the strange figures on the Mayan codices, or it may be a native picture. Beginning at lower left extremity of the inscription is the tail of a snake, and the body is traced entirely across the stone, ending at the left hand of Major Burnham, who stands by it in the photograph. The snake was a Mayan god. Leaving this, the next figure to the right is a circle within a circle. I find this on the original Mayan manuscript known as Codex Cortesianus, published in 1882. This codex is supposed to represent the Mayan gods of the four cardinal points, and the circle within a circle is Muluk, the sixth day. The next figure following along to the right resembles the figure 6, and suggests Kan or south of the codex. Next to this is a period or dot,

REVERSE SIDE OF ESPERANZA STONE, SHOWING RUDE REPRESENTATION OF OWLS.

Face, two eyes, and beak or nostrils indicated.

a common numeral on the codex; then we come to the striking inverted scroll which I find on the Mayan codex, known as the "Dresden," copied in the United States Government Report of 1884.

There is reason for supposing this to indicate water, to the Aztecs at least, and I find it on many beautiful Tusayan water jars in the Smithsonian collection, and repeatedly on Tusayan water bowls.

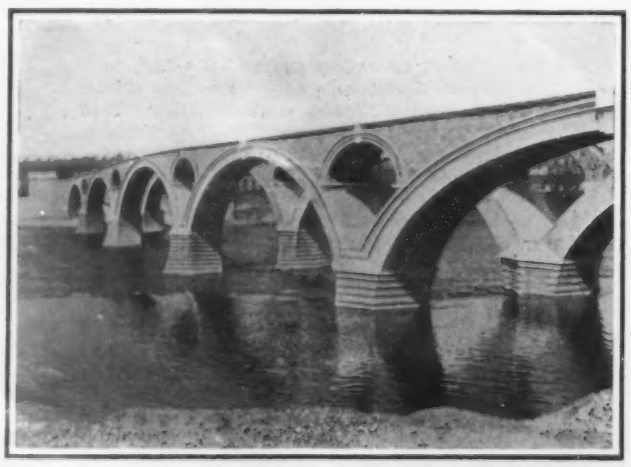
Following the double scroll to the right is another figure somewhat like the 6. On the top of the stone is a cutting resembling a pair of glasses or two eyes. This is a Mayan codex symbol.

The dots and dashes found on the Burnham rock—two parallel lines near the scroll and two above—may be a part of the snake, but they are shown on the Dresden Mayan codex as numerals. Thus, one dot was one, a straight line and a dot, as six, a straight line and two straight lines, as seen near the big volute, indicates ten. Just above the big inverted scroll is a diamond with a line in the center, a symbol I find on the Dresden Mayan codex.

It is impossible in this brief space to go into an elaborate investigation, but I think I have shown at least that most of the symbols are Mayan. All appear in the famous Mayan codices or calendars since the time of the discovery of Yucatan. The conclusion is that ages ago a Mayan expedition passed this way, within two miles of Esperanza, Sonora. They left a record of their travels on this rock. On the left (a common feature of Mayan codices) is a picture representing some feature of the trip. It may be an animal, the big tail suggests the armadillo, or it may be a god. The snake may be the god under whose protection they were; the double inverted cone suggested the discovery of two big rivers—a striking feature of the region—the Maya and the Rio Yaqui, or merely the Swastica sign. The two lines indicate possibly distance, while the other symbols are the cardinal points relating to the year—the sixth day, Muluk—and other data considered of importance. This is what the Burnham stone may mean. What it actually does mean, remains for the scientific men of the world to decide, but Major Burnham and myself are committed to the romantic hypothesis that this is the message of a forebear of the Mayas, some ancient warrior of the long ago, some knight who fought his way to the land of the Yaquis, who brought a great rock down from the mountains and placed upon it the seal of Mayan conquest.

I submitted the photograph to the Field Museum and the Smithsonian and one or two others, and to my surprise the reply was that they could make nothing out of it. I venture to say, even as a layman, that had I the time, I could translate the inscription.

The parallel masonry arches as they appeared before the construction of the concrete floor.



THE NEW BRIDGE AT TOULOUSE.

THE NEW BRIDGE AT TOULOUSE.

BY F. HONORÉ.

The city of Toulouse, which already contains so many interesting monuments, has recently been enriched with a new and very remarkable bridge, called the Bridge of the Amidonniers (starch-makers), which spans the Garonne River a little below the St. Pierre bridge.

The new bridge is the first large work of its peculiar type, which has been constructed in France by Séjourné after the model devised by him for the bridge at Luxemburg. This type of bridge is characterized by the association of two parallel masonry arches connected by a floor of reinforced concrete. The Toulouse bridge, the entire length of which is 730 feet, contains five such pairs of elliptical arches. The largest pair, in the middle of the bridge, has a span of 150 feet. Each arch of the pair is about 10 feet wide, and the two arches are separated by an interval of 33 feet. The corresponding interval in the Luxemburg bridge is only 20 feet. By allowing the transverse girders of the concrete floor to project beyond the arches, the builder has obtained room for two overhanging walks and parapets, each about 10 feet in width. Thus, although the combined width of the two masonry arches is only about 20 feet, the total available width of the bridge is about 70 feet. This method of construction results in great lightness of appearance and an economy of material and money which cannot be obtained by any other system now in use. A masonry bridge of the width of the Toulouse bridge would have cost $60,000 more.

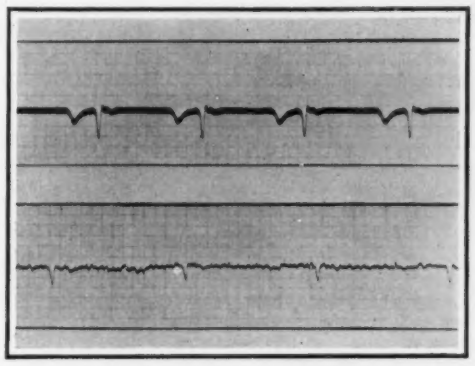
The æsthetic side of the work has not been neglected. The arches are built of red brick. The piers have ornamental cornices resembling those of the old bridges of Minimes and Montaudran. The upstream side of the bridge, facing the city, constitutes the principal façade. On this side the prows of the foundations are very sharp, and the arches are decorated with the molding known as an archivolt. The arms of Toulouse are engraved on a tablet attached to the keystone of the middle arch. The whole work is as graceful as it is original.

ELECTRO-PHOTOGRAPHIC METHOD OF REGISTERING HEART BEATS.

BY JACQUES BOYER.

The graphical methods of studying and recording heart beats which have hitherto been employed give only vague and uncertain indications. The pulse tracings produced by the sphygmograph are by no means exact, and the cardiograph represents only the impact of the heart upon the wall of the chest, as the heart itself is not directly accessible. M. Bull, the assistant director of the Marey Institute of Paris, has perfected a very ingenious method devised by Einthoven, of Leyden, by which an exact record of the movements of the heart can be obtained. This method is based upon an electro-physiological phenomenon which has been observed by many physiologists.

If the terminals of a galvanometer are suitably connected with the freshly extracted heart of a frog or a tortoise, the instrument indicates the existence of an



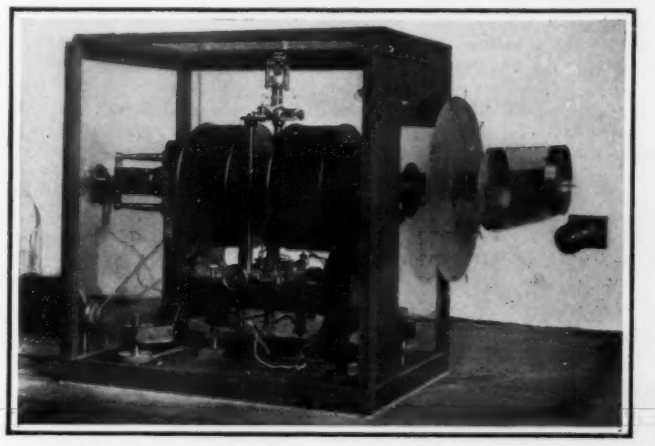
Two curves representing cardiac movements.

The upper tracing was made by a healthy, the lower one by a diseased heart.

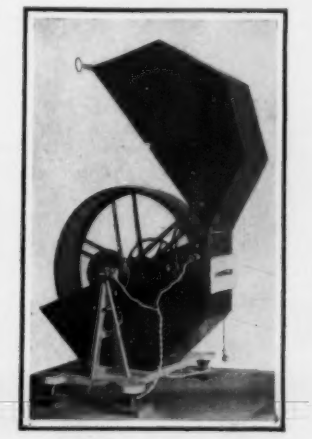
electric current, the strength of which varies as the auricle and the ventricle contract in succession. Owing to the rapidity of the heart's beat, however, these variations cannot be observed directly. Furthermore, the needle of the galvanometer possesses a certain inertia and, consequently, its motions do not agree perfectly with the fluctuations of the electric current.

In order to overcome these technical difficulties, physiologists have found it necessary to employ very sensitive and quickly acting apparatus, which automatically records the variations of the current and thus eliminates the errors involved in direct reading of the rapidly varying deflections. In this way Marey and Lippmann, using the capillary electrometer, obtained records of the movements of the freshly extracted heart of a tortoise. Soon afterward, Waller applied a similar method to the undisturbed hearts of living animals and men, by placing the terminals of the electric recording apparatus in contact with the chest of the subject, one terminal over the apex of the heart and the other near its base, for the cardiac currents flow through the surrounding tissues and the entire body.

Einthoven operated still more conveniently by placing one electrode in each hand of the human subject, whose arms, in this case, may be regarded as prolongations of the conducting wires. Einthoven also replaced the capillary electrometer by the cord galvanometer. This very sensitive instrument consists essentially of a very fine silver-plated filament of quartz, 1/12,000 to 1/6,000 inch in diameter, stretched at right angles to the lines of force between the poles of a powerful electromagnet. A very minute electric current traversing the filament suffices to cause the middle part of the filament to move through the magnetic field. A greatly magnified image of the filament is projected by a lens upon an opaque screen, having a slit at right angles, both to the filament and to the lines of force. The shadow of the moving middle part of the filament is thus thrown through the slit upon a moving band of sensitive photographic paper, where it traces a curve that represents every variation in the strength of the current which traverses the filament.



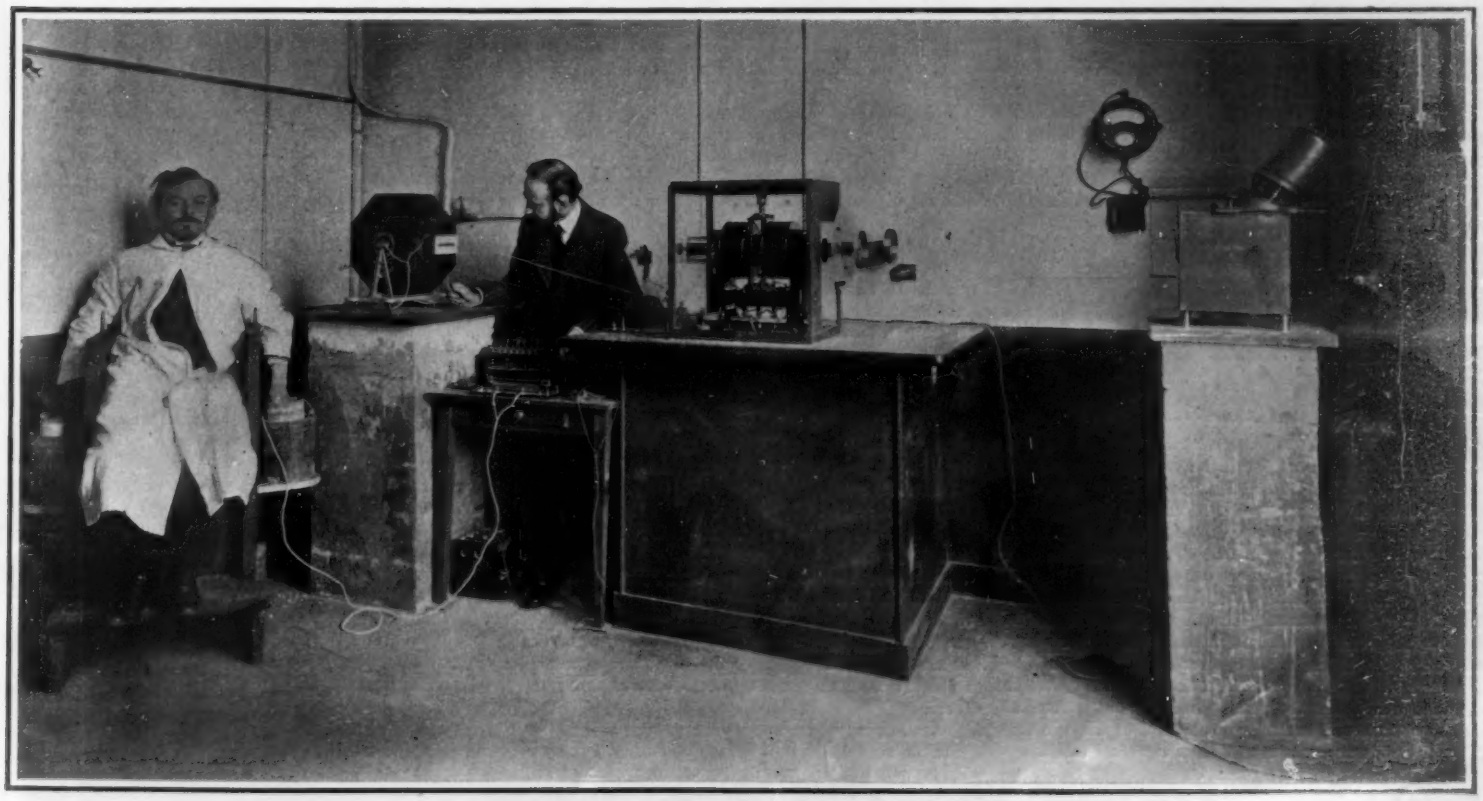
Einthoven's cord galvanometer. The essential element is a silver-plated filament of quartz 1-12000 of an inch in diameter.



Photographic registering apparatus.

Bull has improved Einthoven's method in several ways. As the accompanying illustrations show, he employs a photographic registering apparatus similar to that which he used in making motion pictures of the flight of insects, and which was recently described in the SCIENTIFIC AMERICAN.

He also uses a cord galvanometer and, as a source of illumination, the electric arc. The patient, seated comfortably in an arm-chair, immerses his hands in salt water contained in two vessels which are connected with the terminals of the galvanometer. The displacements of the quartz filament, which correspond to the movements of the heart, are recorded on a band of sensitive paper which is wrapped round a copper drum. The shaft of the drum carries a rotary interrupter by which



Making a record of heart beats with Bull's apparatus.

ELECTRO-PHOTOGRAPHIC METHOD OF REGISTERING HEART BEATS.

the primary circuit of an induction coil is broken a certain number of times in the course of a complete revolution of the drum. By means of a special device, the photographic paper is simultaneously impressed with the tracing of the cardiac movements and with two systems of parallel and equidistant straight lines at right angles to each other. The horizontal divisions correspond to intervals of time, the vertical divisions to the current strengths, and, therefore, to the energy of the cardiac contractions. In the accompanying reproduction of two curves recently recorded at the Marey Institute, the curve having large undulations represents the movements of a normal heart, while the feeble undulations of the other tracing were derived from a patient suffering from endocarditis.

The tracings which have been obtained by Einthoven and Bull show clearly the superiority of the new photo-electric method of studying cardiac movements. It is probable that physicians will soon employ the method regularly in diagnosis, and will become familiar with the curves characteristic of the various lesions of the heart which they have studied clinically. It is an important advantage of the method that the patient need not be moved to the physiological laboratory, for the currents can be conducted by telegraph wires from the vessels of salt water in which the hands are placed to a galvanometer at a distance. Einthoven's laboratory is thus connected with the Leyden hospital by a cable about one mile in length. The process of making the records is facilitated by telephonic communication between the two institutions.

Multiplication of Color Photographs by Contact Printing.

Various methods of multiplying autochrome photographs by contact printing have been described. The special difficulty of this operation is due to the fact that the sensitive films of the two plates are not in immediate contact, but are separated by the thickness of one of the glass plates. Hence, in order to produce a sharp copy, it is necessary to use a parallel or very slightly diverging beam of light. In practice, a bit of magnesium ribbon is burned at the mouth of a long narrow box, at the rear end of which the two autochrome plates are placed. In a recent issue of the Bulletin de la Société française de Photographie, M. Monpillard shows how the same result can be obtained by using a fixed source of light (Nernst lamp, incandescent gas burner, etc.) placed at the principal focus of a condensing lens. This arrangement produces a bundle of parallel rays, in the course of which the two plates are placed in contact with each other. On the same principle Landrieu has devised a method of reproducing autochrome photographs by contact printing with perfect certainty and clearness. The employment of a fixed source of light offers the great advantage of allowing the time of exposure to be regulated in perfect accordance with the character of the original plate. As it is always necessary to interpose a colored screen in the path of the beam of light, the use of a condensing lens alone would require the employment of a very large screen. In order to avoid this necessity Landrieu employs a complete projection lantern, including a condenser and an objective of so long a focus that the beam of light is not very divergent. In these conditions it suffices to place near the objective, either before or behind it, a color screen of small dimensions and of a tint depending upon the quality of the light. With a Nernst lamp of 700 candle-power a condenser of 4½ inches diameter, a suitable objective, and a color screen of the type called "Auto LN," the two autochrome plates should be placed at a distance of about 40 inches from the objective. The exposure varies from 8 to 12 seconds, according to the intensity of the original picture. The sharpness of the copy is practically equal to that of the original.

Electric Blast Furnaces.

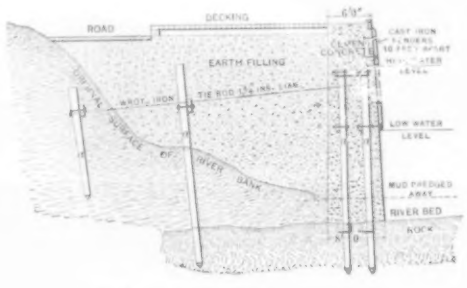
The electric method for use with blast furnaces is being tried in Sweden by the Domnarfuet steel works, which is one of the largest in the country. In its general form and size, the electric blast furnace resembles the usual kind, except that the lower part where the metal is melted is of larger size than usual. As to the kind of current which is used, it is preferred to employ three-phase current at a tension of 40 volts, using a very heavy current of 9,500 amperes. At first an induction type of furnace was used, but the last form is an arc furnace using three electrodes. For the charge of the furnace there is used the proportion of 100 parts hematite and 18 of coke, but, if necessary, the coke can be replaced by wood charcoal. In certain conditions the electric blast furnace gives a product which has the same percentage of carbon as is found in steel, but it appears best to use the furnace to produce pig iron and then to refine this afterward. The cost of production depends mainly on the cost of current and the price of coke. Compared with the usual kind of blast furnace, the electric process consumes only one-third the amount of coke, seeing that in the first case the heat is furnished by the coke, while in the electric furnace it is given by the current. The new process is a favorable one for use in Sweden, for current can be had at a low price, while coke is expensive and the electric method economizes the latter. The commercial use of the electric process depends, therefore, upon the relation between these two factors in any given region, and this differs widely in various countries.

LIGNO-CONCRETE: AN EARLY FORM OF REINFORCED CONSTRUCTION.

BY THOMAS PARKER.

Recently a report on reinforced construction work has been prepared by the engineer in chief of the harbor board at Rockhampton, Australia, speaking very favorably of the durable nature of the structure. This is a river wharf and was designed and carried out seventeen years ago by the writer. At that time no other reinforced concrete work of that type was known, and it was regarded as a pioneer in that kind of construction. The substantial nature of the work, after seventeen years' test, and the opinion of the inspecting engineer, that it will probably be as sound at the end of one hundred years as it is now, will give interest to the following description of the work.

For several years the timber wharves belonging to the city of Rockhampton, although built of the most durable hardwoods of Australia, with Muntz-metal covering to the piles, had been subject to the ravages of the teredo. One costly wharf literally collapsed and fell into the Fitzroy River, having been undermined by the well-known marine scourge which had honeycombed the supporting piles. As a protective measure, the device was adopted of driving piles on the front line of the wharf, as shown in the illustration, and inclosing these piles in monolithic cement concrete. The rock forming the bed of the river was excavated to form two grooves into which the concrete is tied. This concrete front wall is also tied to the land by piles driven into the river bank behind



LIGNO-CONCRETE WHARF, ROCKHAMPTON, AUSTRALIA.

connected with wrought-iron rods 1¾ inches in diameter. The main piles in the front are in couples at 10 feet distance longitudinally, on which are bolted upper and lower walling timbers to stiffen the initial timber structure before inclosing it with the cement concrete. The latter was composed of 6 parts of stone, gravel, and sand to 1 part of Portland cement, and laid successfully within a sheet-piled and canvas curtain. The concrete was mixed and filled into a canvas bag, and lowered down to the bottom, with the mouth of the bag downward, loosely secured by a cord, one end of which reached to the workman above water. When each bag of concrete reached the bottom, or surface of concrete work in progress, by pulling on the cord, the concrete was gently discharged while the bag was slowly hoisted from its resting place. By this method the mixed concrete was laid 18 feet below low water without washing out the cement. A return wall at each end was constructed in a similar manner, of reduced dimensions, to carry the wall to the land and shut out the tidal water from the back of the work. The space behind was then filled up with earth and gravel, and a timber decking laid on top to carry the traffic. Cast-iron fender pieces were fixed to the front of the wall, which thus presents a surface of indestructible materials to the river front.

The advantages of this new method of wharf building were claimed to be the following: Entire protection against the teredo, a substantial structure with a minimum thickness of concrete wall, secured by the hold of the driven piles in the rock and the tie rods to the solid land at the back. Also the avoidance of the objectionable spaces under the old form of timber wharves which harbor rats and filth; and a permanent structure at little more than the cost of timber structures.

It is stated in the Brass World that plaster of Paris will harden rapidly if 0.25 per cent of sodium bisulphate is added to it. The sodium bisulphate should be dissolved in the water used for making the plaster. The strength of the hardened mass is also stated to be increased nearly three times.

WILLIAM JAMES.

BY BENJAMIN GRUENBERG.

The popularization of psychology has exerted a tremendous influence beyond the application in the school room. We have developed a psychology of advertising soap, a psychology of selling mining shares and soliciting subscriptions to magazines, a psychology practically applied by the lawyer when addressing a jury, and an ecclesiastical psychology according to the principles of which sermons are written and funeral eulogies delivered. It seems to us now a matter of course that everyone should prepare himself for his work thoroughly, and that some of us should need to know something about "human nature." But most of us do not realize that thirty years ago there were no professors of psychology in this country, and that the recognition of psychology as something to be studied in a university had to be fought for very strenuously. And in this fight William James was the front and center.

To-day every normal school and every fourth-rate college must give its courses in psychology; while at the universities the researches into the workings of the human brain, as well as of the mind organs of lower animals, is being carried on with a thoroughness, a refinement of technique, and a profusion of valuable results that could not have been foreseen when the little anteroom at Harvard, Prof. James's workshop, full of jars and odors and disorder, was the first psychological laboratory in America.

He embodied to a remarkable degree, both the scientific and the metaphysical temperaments. His great book, which established his reputation in Europe as well as at home, "The Principles of Psychology," was published in 1890. Its popularity extended beyond the sphere of those who were professionally interested in the subject matter. The brilliant style, the rich humor, the constant allusion to everyday incident, made it a favorite with all who were ever introduced to its pages. It has been criticised for these very qualities. Probably nine-tenths of all our teachers who studied psychology at all before the close of the last century studied it out of James's book; and a majority of these same teachers conduct their work on a psychology that is entirely different from the psychology that James taught.

As a direct result of his studies in comparative physiology, James was forced to develop a system of psychology that is characterized to-day as "functional," that is, one that regards the mental processes of man or of any other organism as the outcome of the activities or functions of the living matter of the body, and especially of the living substance of the brain and nerves. This view, now justified by the comparative physiological and psychological studies of Loeb, Verworn, Goltz, Exner, and others, in turn follows from the biological principles that were worked out under the influence of the idea of evolution, made common property by Darwin, Spencer, Huxley, and their coworkers. Such is the force of tradition and our veneration for authorities, that the teacher reads James's chapters on "Habit" and "Memory," in which he insists that we have "memories, not memory," firmly convinced that the pupils are having their "faculties" trained. The new biological psychology, of which William James was the founder in this country, is distinctly opposed to the Aristotelean psychology of faculties. Older teachers who are not trained in modern science will do their teaching according to the gymnasium or training idea of education; while the younger teachers will try to educate a whole boy or a whole girl at a time, instead of separate "faculties."

For many years an investigator and teacher of a science, and for many years a student and teacher of philosophy, it was perhaps to have been expected that William James should have developed a new view of the world; but he modestly called his "Pragmatism" a "new name for some old ways of thinking." His philosophy of pragmatism, the doctrine that the test of truth is its workings or consequences, is indeed not an entirely new thing. Practically the same system has been worked out in this generation by a number of philosophers in Europe as well as in this country. But philosophical doctrines, although they may reappear from time to time, apparently the same old ideas, do in reality become modified by the other forces in society that influence human thought. And so the pragmatism of James is possible only because of the science of the nineteenth century.

Like every attempt to formulate in words a vision of the truth, this system of thought is subject to various misinterpretations that seem to be unavoidable. Men and women with a scientific habit of thought are just as likely to be impressed with the absurdities suggested by a bald statement of the idea as men and women with a metaphysical bent or with no mental bias at all. At the same time, the pragmatic philosophy does constitute a philosophy of life, notwithstanding what the professional philosophers may say to the contrary; and it is in perfect harmony with the methods of modern science. It is a simple matter to ridicule any *ism;* the difficulty in philosophy, as in relig-

fon or in politics, is to come to an understanding of what the other fellow really means.

In spite of the implications of his own work and that of his contemporaries in the field of physiological psychology, William James retained a strong leaning to metaphysics and to dualism. His pragmatism would perhaps justify a faith in the immortality of the soul, on the ground that such faith served as "a balm for men's souls;" but his scientific candor would resent a faith that was in conflict with direct evidence. Seeking reconciliation between the monism of science and the dualism of family tradition and temperamental predisposition, he found it in what he believed to be a higher synthesis—a conception of a pluralistic universe. This idea, like "the fourth dimension," is not easily explained because it is not easily pictured by the mind. But practically it means the rejection of the idea of the absolute.

The method of the scientist requires that we keep our minds open to new evidence; this means that our beliefs, our truths, are merely provisional, always subject to revision. But in a dynamic world the final truth can never be reached. Therefore, there can be for us no absolute truth. This is transcendental pragmatism. At first blush this suggests intellectual chaos, but it really is not as bad as it looks. At the present time this philosophy, without any name, is rapidly making headway among all classes of people. We are learning that law and order are possible politically without any monarchs. We are learning that moral conduct is possible without the absolute of "irrational sanctions." We are learning that many questions cannot be answered by *yes* or *no*. And we are learning that many questions that puzzled the ancients need not be answered at all. All these things indicate a decline of faith in the absolute. But with the passing of the absolute we come to recognize that there are many truths, not one; and these truths, like beauties and goodnesses, are always more or less. There is no absolute truth any more than there is an absolute beauty. What is good to-day was evil yesterday and may be evil again to-morrow. It is easy to say, and it has been said, that such doctrines are subversive of social order and morality. But a philosophical discussion rests upon the assumption that the participants are sincere. The libertine who seeks absolution or a salve for his conscience does not come to the philosopher.

The dynamic view of life and conduct implied in the philosophy of William James has been spreading, largely as the result of the general acceptance among thinking people of the doctrine of evolution; and is accepted by many who have never even heard of pragmatism or of William James. But to this man must be given the credit for a large share in the work of disseminating these ideas; for without teaching it formally, his psychology has carried the message to the teachers, and they, for the most part unconsciously, have passed it on to the rising generation.

What the estimate of the future will be cannot, of course, be anticipated. Already the famous "Briefer Course" is being superseded by textbooks written by some of the pupils of William James. But that the clear thought and deep human sympathies of the great teacher will have left a permanent impression upon our civilization, there can be no doubt.

A $15,000 Prize for Aeroplanes.

Mr. Edwin Gould has offered, through the columns of the SCIENTIFIC AMERICAN, the sum of $15,000, which is to be awarded for the construction of a heavier-than-air flying machine, equipped with more than one motor and propeller.

The conditions governing Mr. Gould's offer were published in the SCIENTIFIC AMERICAN, issue of July 30th.

The Aero Corporation, in charge of the international aviation meeting to be held this autumn, has made some tentative announcements. The opening date will probably be postponed to November 9th. Six foreigners have thus far entered for the Gordon Bennett Trophy. Latham, Le Blanc, and Labouchère come from France, Graham-White, Radley, and McArdle from England, to compete for the cup. The three American defenders will be selected by elimination trials. The sum of $50,000 has been set aside for cash prizes. There will be three prizes of $4,500 each for duration, speed, and altitude. Each of these grand prizes is to be divided into first, second, and third money, the winner receiving $3,000, the second man $1,000, and the third man $500. There will probably be an altitude prize of $5,000 or $10,000 for the man who reaches an altitude of 10,000 feet. There will also be the usual prizes for duration, speed, and altitude, amounting to $250 for each hour during the duration, speed, and altitude tests. A large prize will also be offered for cross-country flights, as well as prizes for passenger carrying, relay messenger service, slow flying, quick starting, and other feats. The aviators will share in the gate receipts, which may be from $100,000 to $300,000.

Correspondence.

NEW WORDS.

To the Editor of the SCIENTIFIC AMERICAN:

In the current issue, your correspondent, Mr. S. Cummings-Huet, desires "another word to replace that misnomer, manufacture, which we use to describe the process of making by machinery articles which were made by manus. We also need a word to describe type-written copy which is not manuscript.

Mechanism may be changed to mechafacture, mechafactory, etc., but motofacture, motofactory, motoproducts, motoproduction, seem to have good etymological basis.

The typewriter is a machine; why not motoscript, or script? W. STORER HOW, D.D.S.

Philadelphia, Pa.

THE ARGENTINE AND UNITED STATES DREADNOUGHTS.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with interest your article comparing the latest American and Argentine dreadnoughts, and also the articles in The Navy to which your arguments refer. While agreeing with many of the points made, I think you have missed the real purport of The Navy's statements, namely, that generally speaking, the "Rivadavia" is a better fighting machine than the "Wyoming." This you practically admit to be true; but in plunging so far into detail as to make the basis of comparison on *full load displacement* instead of *trial load displacement*, the main points in favor of the Argentine vessels have been lost.

The real question is this: Can the "Rivadavia" and "Wyoming" be compared *as they are?* If so, then your arguments are lost. No two warships of different powers in the same class as to date, etc., ever have exactly the same displacement. The "King Edward" class in the British navy are always ranked with our "Connecticuts," yet there is 500 tons difference in their displacements. When battleships get up as high as 27,000 and 30,000 tons, 3,000 tons more or less is not as important as if 16,000-ton ships were being figured on. Therefore I maintain that the "Rivadavia" and "Wyoming" are directly comparable, each being a dreadnought of the latest design and built at the *same time*. Accordingly, The Navy is correct when it states that the private shipyard designers, Americans, assisted by a certain United States naval officer who is a leading factor in the shipbuilding company in question, have "put one over" on the Navy Department designers. In other words, the United States should *now* be building two 30,000-ton, 23-knot ships instead of two of 27,000 tons and 21 knots. It is easy to answer this, of course, and say that every year the ships are larger, but harbor and drydock facilities will soon check this. Your defense of our deficiency in speed is very weak, as there is, judging by past performances of American-built warships, just as much chance for the Argentine as well as the United States dreadnoughts to exceed their contract requirements. The greater radius of action which is obviously evident in the case of the "Rivadavia" is almost the most important feature of a battleship's fighting power. It means a great deal more than an inch or two in thickness of armor, or speedy construction, or cost, etc.

As to the turret arrangement, after all, the fact remains that no matter how small the bow and stern arcs of fire of the "echeloned" turrets of the "Rivadavia" are, she has only 15 degrees less in all the arcs of fire on broadside and 33 1/3 *per cent* more *direct* bow and stern fire than the "Wyoming." In *general* bow and stern fire this advantage decreases to about 50 degrees in the total arcs of fire. This unquestionable superiority of fire was not obtained at a sacrifice of height of gun position, in which respect the "Wyoming" is superior, and I think the next design will show both of these features combined.

The question of location of the central fire-control station is, as you state, still a matter of opinion, but whichever way the decision is rendered, a low, heavily armored position or the present skeleton masts, the Argentine vessels have the best, while ours are equipped only with the skeleton masts.

Finally, I would say as a matter of general interest that I have learned on fairly reliable authority that the name of the second Argentine dreadnought is "Acorazado." HAROLD M. KENNARD.

Brooklyn, N. Y.

The "Polly," the oldest American merchant vessel, was recently in New York harbor discharging a cargo taken on board at Bridgeport, Conn. So lightly has time touched this vessel that, despite her 106 years, she remains in as good condition as most mercantile ships of one-tenth of her age. She is only 61 feet in length, and has only 45 tons net burden, but she has a notoriety which is much more substantial. Her former skipper and owner, Capt. Upton, armed his crew with axes and cutlasses, and few privateers enjoyed more successful cruises in 1812. The "Polly's" rig was that of a sloop, and her captures of British merchantmen were many along the New England coast, until she was overhauled by the British frigate "Phœbe," when Upton and his ship and men were made captive.

Cold Storage Eggs in France.

According to Dr. Bordas, of the French council of public hygiene, the cold storage of eggs is rapidly increasing in France, and will soon supplant liming and the other processes now employed for preserving eggs. Dr. Bordas insists on maintaining a rigorous distinction between fresh eggs and cold storage eggs, although the latter are very superior to limed eggs. Five, six or even seven months of cold storage do not appreciably alter the appearance or odor of eggs, while lime water, acting for a much shorter period, makes the albumen slightly yellow and gives the egg the characteristic odor of lime. An egg which has been kept three or four months in cold storage is still in perfect condition to be eaten, soft-boiled, from the shell, but a limed egg of the same age is unfit for this use. After the fourth month of cold storage the air space of the egg becomes enlarged by evaporation, but the egg is still perfectly fit for pastry making and most culinary uses. In recent years, especially in the districts of Lyons and Bordeaux, French preserved eggs have suffered from competition with preserved yolks of foreign origin. For hygienic reasons it is desirable that cold storage eggs should be used by all bakers and pastry cooks.

The Harvard-Boston Aviation Meet.

The Harvard Aeronautical Society, which, although less than a year old, now has nearly 400 members, is promoting the first aviation meet in New England, and for that matter, the first meet of this kind of any consequence to be held in America up to the present time. The society has received the co-operation of President Lowell, of Harvard University, and of Mayor Fitzgerald, of Boston, and the Boston Globe has put up a cash prize of $10,000 for the fastest flight over the water from the aviation field at Atlantic, out around Boston Light and back again, and thence to the State House and return—a total distance of about 25 miles. The society also offers a handsome gold trophy (the Harvard Cup) for the best record at dropping bombs upon a battleship outlined upon the field. In addition to these large prizes, first, second and third prizes of $3,000, $2,000 and $1,000 will be awarded in the speed and altitude contests, and first and second prizes of $2,000 and $1,000 in the duration and distance events. In case of a new world's record being made in any of these events, $1,000 extra will be added to the first prize. Other prizes to be awarded are as follows: Slowest lap, $1,000 and $500; quickest start, $100 and $50; accuracy, $500 and $250. The total amount of prize money to be won is about $41,000.

The success of the meet has been assured by the engaging of such aviators as Brookins and Johnstone with their Wright biplanes; Curtiss and Willard with their Curtiss biplanes; Claude Graham-White with his Farman biplane and Blériot monoplane; A. V. Roe with his triplane—the only machine of this kind which has made successful flights; and three of the leading French aviators with their monoplanes. A number of new American aviators will make their debuts at this meet also. Clifford B. Harmon made a few flights during the first days of the meet. One of the novel machines entered is the Blériot monoplane of Stanley Y. Beach. This machine is fitted with the Sperry gyroscope for assuring its transverse stability. It is the first aeroplane upon which the gyroscope has been used for this purpose. A demonstration of kite flying will be given by Samuel F. Perkins, of Boston, who will send aloft Miss Emily Willard, sister of the aviator, suspended from a kite of large size and of special construction.

The meet lasts from the 3rd to the 10th instant. A full account of it will appear in our next issue.

The Current Supplement.

Mr. J. W. Titcomb continues his splendid and instructive paper on "How Fish Are Hatched" in the current SUPPLEMENT, No. 1810.—The marine suction producer-gas engines on the River Rhine are described and illustrated.—Death by lightning is described by John Knott.—The safety provisions employed by the United States Steel Corporation are discussed and illustrated by Mr. David S. Beyer.—To the question: "Is Matter Eternal?" Mr. F. W. Henkel replies in the terms of the modern physicist.—The sand blast and its many uses is the subject of an excellent article.—On account of the present activity in the rubber industry, due to the enormously increased demand for rubber, the presentation of a new substance which possesses a number of valuable qualities, and which can be used in many of the arts and industries where rubber and similar materials are employed, is of timely interest. Dr. F. G. Wiechmann describes such a substance of his own invention, which he calls "Protal."

Opening of the Pennsylvania Terminal Station in New York

HOW A GREAT RAILROAD SYSTEM WAS BROUGHT INTO THE METROPOLIS

The highest testimony that can be given to the character of the work done by the engineers in the construction of the Pennsylvania Railroad Company's tunnels and terminal station, New York, is to say that it is worthy of the best traditions of that great railroad. Preliminary to the public opening, the company ran some special trains conveying invited guests from Jersey to Long Island. The impression made upon the mind of the representative of the Scientific American was that in every particular the buildings, plant, track and the rolling stock were of the very highest quality. Particularly noticeable was the accuracy both of the grade and alignment of the tunnels, and the perfectly smooth motion of the train, even at high speed. Furthermore, the advantage of the unusually thick, concrete lining of 22 inches placed in the tubes showed to great advantage as a noise deadener. It is evident that the heaviest steam trains may be run through these tunnels at any speed that the company may wish to adopt.

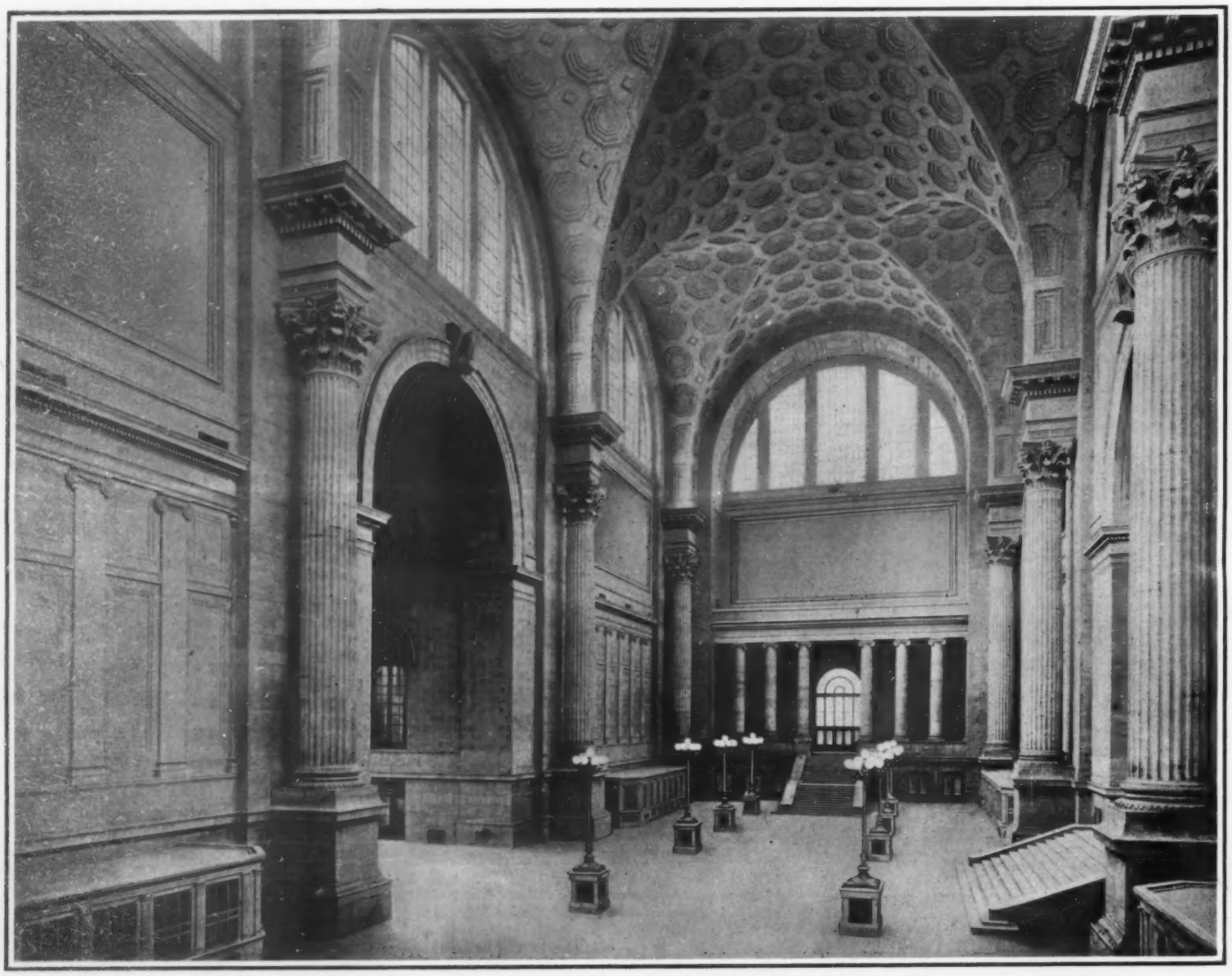
For the genesis of this great work, we must go back to the year 1871, when the company, on leasing the United Railroads of New Jersey, which terminated in Jersey City, began to look longingly across the North River to Manhattan, as being the logical point for the terminus of their system. In 1884, a proposition was entertained to build the famous "North River Bridge" across the Hudson River, a monumental structure, with a river span of over 3,000 feet, and a capacity of fourteen railroad tracks carried upon two decks. The plans for this bridge, which were drawn by Gustav Lindenthal, were adopted, and it was only the failure of the other railroads terminating in Jersey City to bear their equitable share of the cost, which prevented the Pennsylvania Railroad Company from erecting what, probably for all time, would have been the greatest work of bridge engineering in existence.

In 1900 the control of the Long Island Railroad passed into the hands of the Pennsylvania Railroad Company, and the desirability of connecting that system with the parent line, coupled with the strong desire for a terminal in Manhattan, led to the elaborate plan of tunnels and terminals which, after many years of continuous work, has now been completed.

The New York tunnel extension commences at Harrison, New Jersey, a short distance to the east of Newark. Here has been laid out a large transfer yard where the steam locomotives are switched off, and the huge electric locomotives are coupled on. Here passengers may transfer to electric trains which will run into the Church and Cortlandt Street station, Manhattan, of the Hudson and Manhattan Railway. Through trains for New York will cross the Jersey meadows on a double-track elevated embankment to Bergen Hill, where they enter the western portals of the tunnel system. The tracks pass under the North River in two cast-iron tubes, built up of sections of iron rings, each two and a half feet in length. The line falls and rises again on easy grades, reaching a maximum depth of 97 feet below mean high water. In view of the fast and heavy character of the traffic, not only were the tubes built of unusually heavy section, each entire ring weighing 15 tons, but the interior is lined throughout with concrete having a uniform thickness of 22 inches. The tunnels were driven from opposite sides of the river by means of massive shields, each of which weighed 194 tons. Although each shield traveled about 3,000 feet to the meeting point below mid-stream, the junction was effected with absolute accuracy.

At Tenth Avenue, Manhattan, the two tubes, each containing a single track, reach the entrance to the great station yard, the excavation for which involved the removal of three million cubic yards of rock, and the average depth of which is forty-five feet below the adjoining street level. As the tracks enter the yard they spread out to a total number of 21, and fill the whole area from Thirty-first to Thirty-third Streets. The area of the station and yard, which extends from Tenth Avenue to Seventh Avenue, is twenty-eight acres, and seven and three-quarter acres of this is covered by the station building. The station itself is supported by 650 massive steel columns, the greatest weight on any single column being 1,658 tons, and the total weight of steel in the station building being 27,500 tons.

The station itself is a magnificent structure (certainly the finest in New York city) and worthy to rank as one of the notable buildings of the world. It has a frontage on the streets of 788 feet, and of 432 feet on the avenues. In designing the exterior of the building, Messrs. McKim, Meade & White, the architects, endeavored to embody two ideas: To express not only the exterior design of a great railway station in the generally accepted form, but also to give to the building the character of a modern gateway and entrance to a great metropolis. Keeping these two objects in view, the plan of the station was so drawn as to give the greatest number of lines of circulation for the passenger traffic possible. The structure has been described as a monumental bridge over the tracks, with entrances to the streets and the main avenues, and on all four sides, thus affording a maximum of entrance and exit facilities. The imposing Seventh Avenue façade symbolizes in the most impressive manner a monumental gateway. It is composed principally of a Roman Doric colonnade, each of whose columns is 4 feet 6 inches in diameter and 35 feet high. From this entrance an arcade 45 feet wide by 225 feet long leads to the main waiting room, entrance to which is made by a grand stairway 40 feet wide, at the head of which



This vast interior, 109 feet wide, 315 feet long, with a clear uplift of 150 feet from floor to ceiling, is modeled after the basilicas of ancient Rome. It is finished in Travertine stone imported from Italy.

The main waiting room.

OPENING OF THE PENNSYLVANIA RAILROAD TERMINAL AND TUNNELS, NEW YORK.

is a striking statue of Alexander John Cassatt, the moving spirit, during his later life, of the great work which has just been thrown open to the public.

Apart from its long reaches of imposing façades, the distinctive feature of the station is the waiting room, which is 314 feet 8 inches in length by 108 feet 8 inches in width, and whose stupendous vault spans the great interior at a height of 150 feet above the floor.

This magnificent hall, dignified with massive, classic columns and enriched by the warm soft tones of its clothing of Travertine stone (brought all the way from the quarries in the Roman Campagna, near Tivoli) is one of the most impressive interiors in the world. In clear height it is matched only by the nave of the Cologne Cathedral.

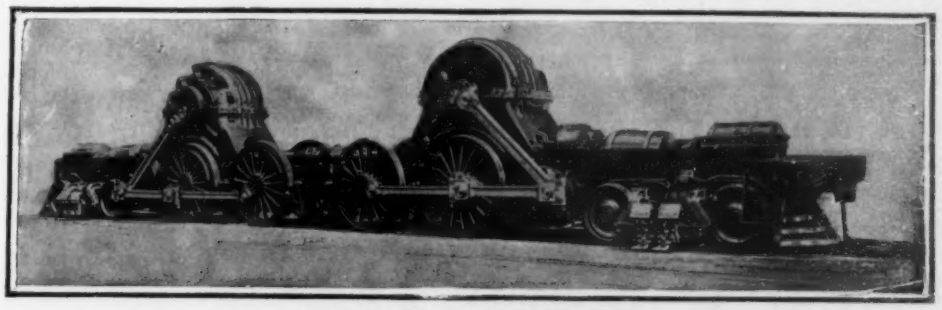
Parallel to the main waiting room, and of equal length and 200 feet in width, is a concourse from which access is had to the platforms below by stairways.

It should be mentioned that the storage tracks of the station will accommodate 386 cars, and that there are at the station some four miles of standing tracks. The station contains eleven passenger platforms, with 25 baggage and express elevators. The maximum capacity in trains per hour of all the tunnels is 144, and the initial daily service will consist of about 600 Long Island trains, and 400 trains to and from the Pennsylvania system to the West.

From the station, the Manhattan crosstown twin tunnels, containing four tracks in all, extend to the East River, where the two-track tunnels are continued as four separate tube tunnels below the river to Long Island. Here they emerge at what is known as Sunnyside Yard, which is 5,500 feet long, 1,550 feet wide, and contains 53 miles of tracks with a capacity of 1,387 cars. From Sunnyside Yard tracks lead to the New York connecting railway, which will cross Hell Gate by the largest steel arch in the world with a span of 1,000 feet, and will form a junction with the New York, New Haven & Hartford Railroad system, and so provide an all-rail connection from the South to New England points.

Not the least important of the improvements has been the electrification of the Long Island system, which, now that the new station is open, is placed in close relation with the heart of Manhattan Island. The service will be operated by multiple-unit trains, running under short headway. As evidence of the valuable character of this improvement, it may be mentioned that Jamaica is now brought within 18 minutes of Manhattan, and that similar reductions have been made in the schedule to other Long Island towns.

While the service to Long Island will be worked by multiple-unit trains, that to the West, consisting mainly of through express trains, will be operated by the huge locomotives, of which we present illustrations. These powerful engines, each of which has a capacity of 4,000 horse-power, exert a drawbar pull of 60,000 pounds, and weigh complete 166 tons.



Chassis of the new electric locomotive.

Drive wheels, 68 inches diameter. Truck wheels, 36 inches. Length over all, 65 feet.

The new Pennsylvania Railroad electric locomotive.

Weight, 166 tons. Horse-power, 4,000. Drawbar pull, 60,000 pounds.

Greenwich Time in France.

The long-discussed scientific question of the adoption of Greenwich time in France is about to be finally disposed of by the introduction of a bill in the Chamber of French Deputies making Greenwich time compulsory instead of Paris time, which differs from it about nine minutes. This desirable reform in the initial meridian of longitude would practically harmonize almost the whole of Europe in the matter of longitudinal time.

If the bill becomes a law, France will thus be brought into line with the zone system of referring time to meridians differing by an integral number of hours from the Greenwich meridian.

American scientists took the initiative in establishing a time system for the whole world in what is now known as the Prime Meridian Conference, which convened at Washington in 1882. Twenty-five nations were represented, but there was no power to bind their governments. However, the conference recommended the use of Greenwich civil time, to be reckoned from zero up to 24 hours; and in accordance with this resolution the United States and Canada selected a series of standard meridians differing in longitude from that of Greenwich, England, by exact multiples of 15 degrees.

The action of this conference was not so favorably received on the Continent, and France retained her own standard of time.

The Australian railway adopted the Greenwich time in 1886.

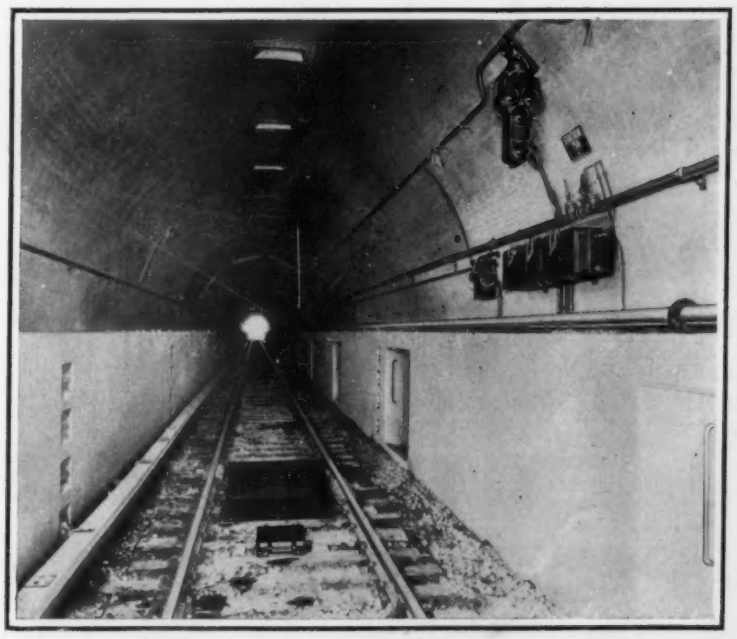
In 1889 the matter was brought before the German Railway Union and the German Reichstag.

Belgium and Holland were the first Continental nations to adopt standard time, and other countries followed, except France.

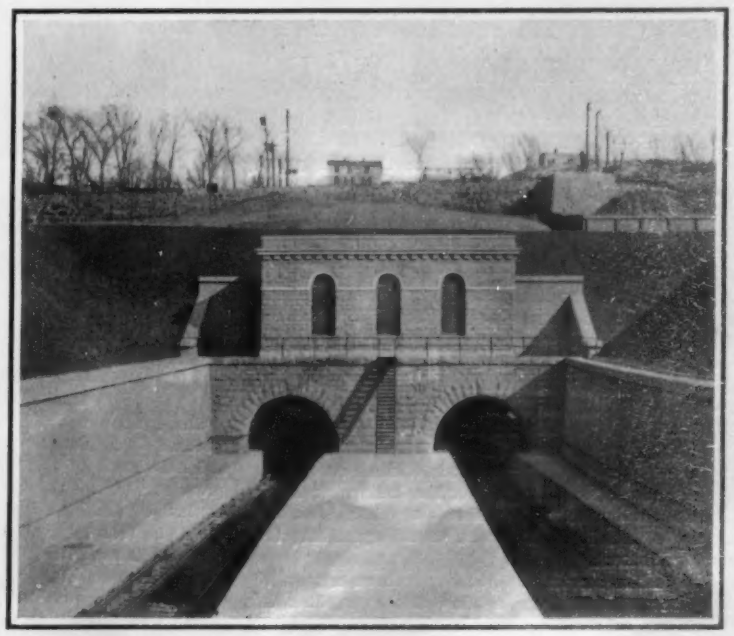
French authorities objected, it is said, purely on scientific ground, urging that Greenwich was too far north for an observatory to fix the standard meridian, and the position of Greenwich with respect to the observatories of the Continent was not thus accurately known.

M. Millerand, Minister of Public Works, has been asked by the French Cabinet to support the proposal to substitute Greenwich time for the time of the Paris meridian when the matter is brought before the Chamber.

In view of the recent aeroplane accidents, the First President of Brandenburg has issued an ordinance applying to that province and to Berlin, whereby all persons who do not possess the aviator's certification of the Fédération Aeronautique Internationale are prohibited from undertaking flying machine ascents for spectacular purposes and cross-country flights. Notice of exhibition flights must be given to the police three days beforehand, and flights over towns are forbidden. The penalty for infringement of any of the above regulations is $15. The ordinance is of interest in view of the fact that a government commission is now engaged in working out a scheme for a control of the air tariff in Russia, the completion of which is expected shortly.



Stretch of finished land tunnel, showing automatic signal apparatus.



Portals at Bergen Hill of the tunnels leading below the Hudson River to Manhattan.

OPENING OF THE PENNSYLVANIA TERMINAL STATION IN NEW YORK.

MAGIC FOR AMATEURS—IX

CARD AND DOMINO TRICKS

BY W. H. RADCLIFFE

NO. 20. PRESSING A CARD THROUGH A PACK.

In the trick to be described, one of the spectators is given a chance to show his ability as a magician. A pack of cards is passed out to be shuffled and cut, and

Fig. 31.—POSITION OF HANDS IN PRESSING CARD THROUGH A PACK.

when returned is placed face downward upon a table.

The spectators are asked to step forward and to examine the top card of the pack. After they have done so and the card has been replaced, one of them is requested to clasp both hands together and press down upon the pack with all his strength. Under pretense that the would-be magician is not holding

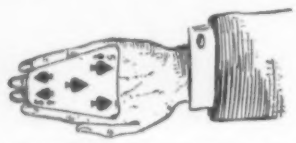


Fig. 32.—CARD CANNOT BE SEEN FROM PALM SIDE OF HAND.

his hands in the proper position on the pack, the performer steps forward to show him how it should be done. Just beforehand, however, the performer, when not observed, moistens a part of the back of his left hand with his tongue. Then clasping his hands together, left one undermost as in Fig. 31, he presses firmly down upon the pack as there indicated. The moisture on the back of the left hand causes the top card of the pack to adhere; and if care is taken to properly place this hand on the pack and raise it without exposing its back to view, no one will notice the card brought up with it. As soon as his hands are withdrawn and the spectators are again watching the would-be magician hold down the pack, the performer secretly takes the abstracted card in his right hand. Bringing both hands together behind his back, he slips one of the side edges of the card between the first and second fingers of his right hand, and the other side edge between the third and fourth fingers, so that the card is held at the back of the hand as in Fig. 32. If the edges are not inserted too far between the fingers, the card will not be seen when the hand is opened palm side up. Extending the right hand, palm side upward, beneath the table, and requesting the would-be magician to press extra heavily upon the pack, the performer, by doubling up his right hand as in Fig. 33, is enabled to pull the card by means of his thumb into the palm of his right hand and show it there to the spectators. Another method of producing the card is from the side coat pocket of the would-be magician. The card can easily be slipped into his pocket without detection while the performer is standing alongside him and the attention of the spectators is directed at the pack.

Fig. 33.—REGAINING POSSESSION OF CARD WHEN HELD AS IN Fig. 32.

NO. 21. A DOMINO TRICK IN TELEPATHY.

Most people think they know all there is to know about dominoes, but how many of them if kept blindfolded in a distant room could tell the end numbers on a matched row over three feet long? By following the directions given here, the performer is enabled to give the correct answer as often as the spectators are willing to match up the dominoes. He simply requests the privilege of shuffling the pieces beforehand to assure himself, as he expresses it, of the dominoes being well mixed together. After leaving the room he is blindfolded as thoroughly as may be desired, and guarded by one of the audience.

As soon as all pieces have been matched together as in a draw game of dominoes, namely, so that a four is coupled with a four, a six with a six, and so on, he calls out the end numbers correctly, although still blindfolded and guarded.

He claims this can be done by reading the minds of those who arrange the dominoes, in other words, by telepathy. Although in the light of recent investigations it is quite possible that this might be done, the performer resorts to a much simpler method. In shuffling the dominoes before leaving the room, he secretes one in his hand, and on his way to be blindfolded glances at the number of dots on it. Owing to the fact that a complete set of dominoes matched together as previously explained forms an endless

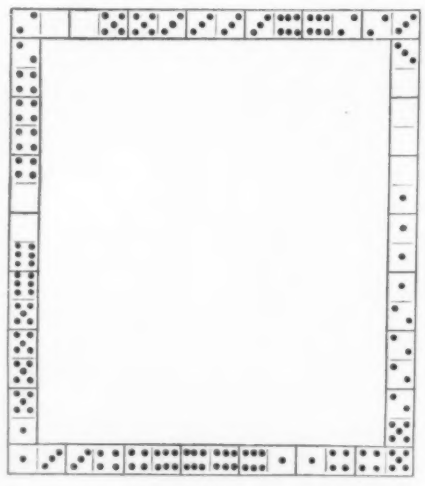


Fig. 34.—AN ENDLESS CHAIN OF DOMINOES MAKE POSSIBLE A TRICK IN TELEPATHY.

chain as in Fig. 34, it is evident if one domino be taken away the numbers on it will be the same as those on the ends of the matched row. For example, if "double four" be taken, there will be four dots at each end of the row; if the domino "two-five" be taken, there will be two dots at one end and five dots at the other end of the row. A seemingly inexplicable phenomenon can thus be produced in an extremely simple manner.

Trained Women Nurses Wanted by the Government.

The news item which appeared in many papers recently to the effect that the government would not employ any more women in the federal departments at Washington, seemed to work a hardship for those who were about to take the examinations. There is one field, however, in the government service, in which there appears to be a shortage most of the time, and that is the position of trained woman nurse. That this is true is evidenced by the fact that the civil service commission finds it necessary to hold four or five examinations each year to fill vacancies and newly created posts.

There are three services to which trained nurses are assigned—the Indian service, to which most of the women who pass express a preference, the Philippines, and at Panama.

The salary, which in most cases includes quarters, board and laundry, ranges anywhere from fifty dollars to eighty-five dollars a month. In the Indian service the entrance salary ranges from $600 to $720 a year, including quarters. That of the Philippine service is $50 a month to start, and is increased after six months, while an adequate allowance is made for laundry in addition to board and quarters.

In the canal service trained women nurses receive an entrance salary of $60 a month, with board, quarters and laundry. The majority of them receive $75 a month through promotion.

The work of the Philippine and Isthmian services is along general lines, but that of the Indian service is of a special character, the diseases of tuberculosis and trachoma, this latter a disease of the eye, being the most prominent.

The Indian service is directing such an aggressive and thorough campaign against these two diseases, which are so rapidly depopulating the tribes of the southwest, that an appropriation of $40,000 was asked of Congress to be used in the fight.

In the campaign against tuberculosis, small camps, scattered about the various reservations, have been found the most effective weapon. While the Indian is susceptible to all forms of the disease, he responds quickly to treatment, in its early stages.

In the fight against trachoma three physicians and one specially trained nurse are kept busy traveling between reservations, treating cases on the ground where necessary, and, whenever possible, sending the infected person to the special hospital at Phœnix, Arizona.

This special hospital is proving a great success and a most effective weapon against the spread of the disease. Trachoma is more generally prevalent among the Indians of the southwest than in any other section of the United States, as it has come up rapidly into New Mexico and Arizona from Mexico and the southern Pacific coast. So far 22 per cent of the Indians have been found to be victims of trachoma.

The field for trained women nurses is a wide one, and there is usually a dearth of good nurses, who are fitted to take to the field for this work. The army and navy each have a corps of women nurses, and it has been found that their work was all that could be desired. At the Naval Hospital in Yokohama there are several women nurses, and in several other military hospitals they are and have been in great demand.

Raising Sunken Ships.

The French submarine boat "Narval," which was wrecked and sunk some time ago, has been raised and has served for some interesting experiments, which prove the unreliability of the often recommended method of raising sunken ships by filling them with air. The "Narval" was sunk by admitting water, and was then filled with air under pressure by the torpedo pumps of two other submarines. Before sufficient water could be expelled, the cover of the manhole, which was connected with a view of resisting external pressure alone, was forced open, and the water rushed in. The cover was then made fast by divers, and air was again pumped into the hull. Suddenly the stern of the boat appeared above the surface of the water, while the bow still touched the bottom, so that the boat assumed an almost vertical position. Finally, the bow was also raised from the bottom by pumping in still more air.

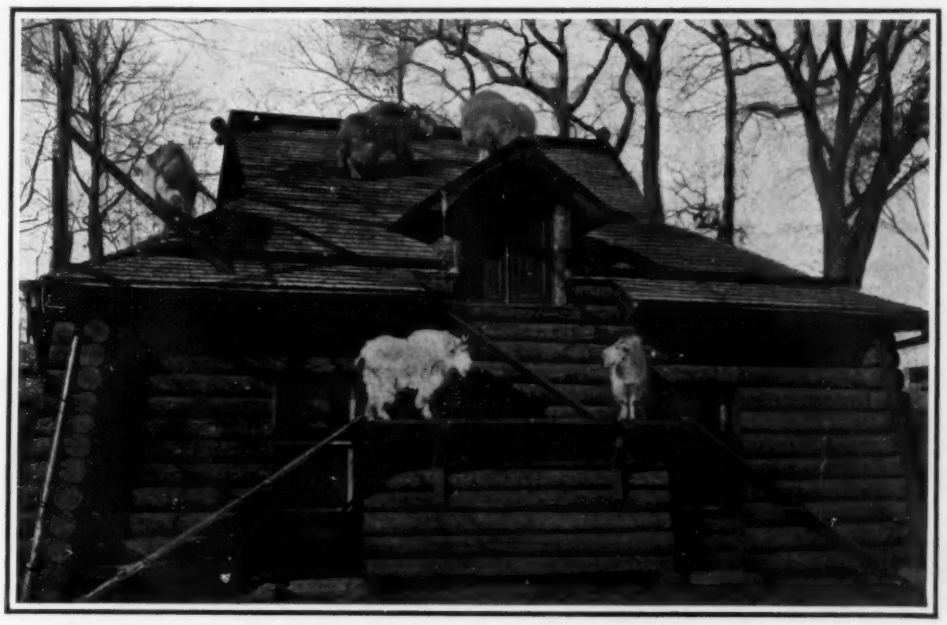
In contrast with this, the process actually used in the practical raising of the vessel was far simpler and easier. A scow was anchored over the sunken boat, to which it was attached by chains at low tide. The rising tide lifted the scow and the submarine, and at high tide they could be towed to port. It was shown that it was possible to raise the submarine without making use of the tide, by sinking the scow to a certain depth by means of water ballast, making it fast to the submarine, and then pumping out the water.

The National Association of Manufacturers has recently taken up the important questions of prevention of accidents and industrial indemnity insurance, and has sent a commission abroad to study methods and practice in Europe and Great Britain. The commission, which is the first of its kind organized by any American industrial association to study the above subjects, left New York city on July 14th direct for Bremen. The commission will establish headquarters in Berlin and London. Investigators and actuaries will be appointed in both places, and from these centers the commission will investigate conditions in important cities. Special attention will be given to the museums of safety devices in Berlin, Munich, and the Hague. The prevention of accidents will form one of the most important subjects to be studied. The commission believes that fully 50 per cent of industrial accidents are preventable, and that the scientific and practical application of safety appliances is of the utmost importance, not only from a humanitarian point of view, but also because of national, civic, and individual economy. It is stated that cordial and intimate relations have already been established with the leading continental professors of industrial economy and the heads of the great industrial associations both on the Continent and in England.

ACCLIMATING THE ROCKY MOUNTAIN GOAT

BY WALTER L. BEASLEY

A noteworthy result of considerable zoological interest and scientific importance has obtained from the well-directed and successful efforts of Director W. T. Hornaday of the New York Zoological Park, in acclimating the Rocky Mountain goat. This is the first attempt to induce these animals, whose accustomed habitat is in the rarefied atmosphere of the highest peaks of the snow-clad Rockies of eight to ten thousand feet elevation, to live and thrive in the low altitude of the Atlantic coast. Hitherto, all young kids intended for exhibition in the East, have died in a few months after their arrival. In October, 1905, Dr. Hornaday personally conducted to New York the present herd of five goats, then young kids about five months old, on a three thousand mile journey from Fort Steele, British Columbia, where they were captured in the mountains a few weeks after their birth. Notwithstanding the humid climate and wholly unaccustomed food of their new surroundings, all members of the herd have remained in perfect health since their arrival in the Park. Their large corral, a rustic log barn for shelter at night, and a background of natural rocks to climb upon, afford them ideal conditions for exercise. In May, 1908, the first Rocky Mountain goat ever bred in captivity was born in the New York Zoological Park. This specimen, a male, is now in perfect health, nearly mature, and is shown in one of our illustrations. Since "Phillip" is a bit too fond of fencing, it has been necessary to saw off the skewer-like tips of his horns for the general safety of the other members of the flock. The second addition to the herd occurred on June 8th of the present year in the birth of a fine young male. The kid is a vigorous specimen, and promises to equal the first one, "Phillip." The collection now numbers six animals; but two losses having occurred, the mother of "Phillip," and a young female that was received on deposit, May, 1909. These interesting acrobatic creatures, with their long shaggy, white coats, are among the most striking and picturesque wild animals in the New York Zoological Park. They are the only ones in captivity in the United States, and possibly not a single specimen can be seen at present on the whole continent of Europe. In order to satisfy their remarkable habit and fitness for climbing, a unique aerial playground is furnished them, in the shape of the precipitous roof of the rustic barn of their inclosure. An amusing and spectacular sight is afforded by the flock of these sure-footed creatures scaling the incline and scampering over and down the steep roof. This droll and unusual scene is pictured in one of the accompanying illustrations.



Herd of Rocky Mountain goats on their roof playground in the New York Zoological Park.

Keeper McEnroe furnishes the herd with a plentiful and tempting diet in the shape of the best clover hay, crushed oats, sliced carrots and chopped apples. The full grown male mountain goat stands from 30 to 41 inches high at the shoulder, and weighs from 250 to 300 pounds.

Owing to their great strength and wonderful climbing ability, their main dependence for safety is among the highest and inaccessible peaks of the mountains, beyond the reach of various enemies, like the puma, wolf, bear, and likewise man, to a certain degree. There is no living animal that can surpass the climbing feats of the mountain goat, or take such desperate chances on the rocks. The animal is practically devoid of all fear of danger, and is built for stability and strength rather than for speed. The hoofs have large twin masses of rubber-like material, a ball of which is soft, and inclosed in a shell of hard consistency. It is chiefly the use of the soft mass which enables the animals to climb. Their rear hoofs are used as a brake for descending inclines that are steep and smooth. In climbing almost perpendicular walls or rocks, the powerful front legs are used to reach out for foot-holds, while each hoof is firmly planted to avoid slips and to detect loose rocks. The heavy body is lifted by sheer strength and skill. The animal is a "cropper," and lives by cropping the thick leaves, stems, etc., which grow in great abundance in the patches of the forests that occur between the timber line and the snow fields. The preservation of wild life is one of the great objects to which the New York Zoological Society has constantly devoted its attention and efforts, and Director W. T. Hornaday, assisted by Mr. John M. Phillips, of Pittsburg, has scored an achievement of far-reaching zoological importance, after several years of energetic endeavor and appeal, by being instrumental in having set aside an extensive game reserve and breeding ground for the mountain goat in British Columbia. Recently the Legislative Council issued a proclamation which converts into an absolute preserve about 450 miles of territory between the Elk and the Bull rivers, and around Monroe Lake, and which has been named "Goat Mountain Park." The area contains about 1,000 head of mountain goats and 200 of mountain sheep, all living and breeding the year round.

The official annual report of the National Transcontinental Railway Commission, recently issued at Ottawa, covering the work of the last fiscal year, shows that 63 per cent of the grading on the whole line from Moncton to Winnipeg is now finished, and 45 per cent of the bridging. During the year 521 miles of track were laid, the track mileage on March 31st totaling 760, with an additional 165 miles of sidings. Steel is now laid on about half the distance from Moncton to Winnipeg. Construction work is proceeding vigorously this summer on every section of the line, and it is expected that the road will be ready for through traffic in August or September of 1912. The line from Winnipeg to Fort William will be opened for regular traffic in August.

Fine specimen of a nearly mature male Rocky Mountain goat now in captivity in the New York Zoological Park.

A Rocky Mountain goat when two weeks old. The second kid ever known to be born in captivity.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

METHOD OF REPRODUCING OUTLINES OF A FORM.—Edith R. Sextone, Grenola, Kan. The invention has reference to a method for reproducing the outlines of a form, the more particular purpose being the provision of a form mold for defining the shape of a bust, and further refers to means for faithfully preserving the outlines of the form and fixing the outlines in the bust.

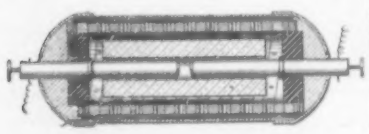
SWEAT-BAND.—F. J. Lafermann, Jamestown, N. D. Among the principal objects in view in this case are: to provide a band for hats, adapted to secure the hat by engaging impingement of the head in intermittent areas; to provide a band adapted to carry a medicinal ingredient or perfume; and to provide a band adapted to facilitate ventilation of the head above the hat.

BOOT AND SHOE.—J. Jefferson, Salt Lake City, Utah. The object here is to provide a device which can be conveniently brought to a closing position and as readily and rapidly carried to a releasing position, so that the boot or shoe can be unobstructively removed from the foot, and which is durable and effective, easy to manufacture and attractive in appearance.

TROUSERS.—J. Greenwald, New York, N. Y. This improvement provides belt retaining devices formed integrally with the trousers; provides loops for the retention of the belt, which loops nest close and enter into the design of the trousers to avoid the makeshift appearance of the present loop construction; and provides a belt holding structure wherein the belt is interweaved to the inner and outer sides of sections of the trouser construction.

Electrical Devices.

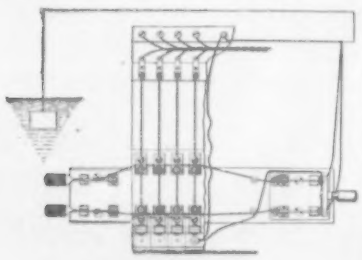
HIGH TEMPERATURE ALARM.—W. P. Pierce, Kirkwood P. O., Missouri. This device is especially useful as a fire alarm in vessels, houses, stores, or the like, or it may be used on journaled bearings to prevent a hot-box. The device comprises two members normally held



HIGH TEMPERATURE ALARM.

out of contact by means of a fusible substance which holds a spring. When this substance melts at the predetermined temperature the spring is released and forces the two members into contact, thus completing the circuit of an alarm.

LIGHTNING-ARRESTER.—W. E. Phelps, Colebrook, Ohio. The purpose of the invention is to provide a lightning arrester suitable for auxiliary use in connection with other lightning arresters and with various parts generally



LIGHTNING ARRESTER.

employed in telephone exchanges. In this lightning arrester, a line wire or its equivalent is movable at will into and out of engagement with various conducting members for the purpose of grounding or ungrounding all of these members by a single movement of the hand lever.

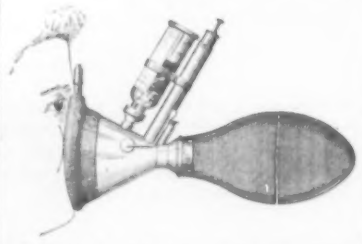
Of Interest to Farmers.

HAY-PRESS.—J. H. Sawyer, Lexington, Ky. The aim of the inventor is to provide a hay press of simple construction and easily operated, and whereby the baling wires will be automatically placed at the completion of the pressing operation by the reverse movement of the plunger, the movement of which is continuous.

Of General Interest.

FRUIT-PACKER'S TABLE.—F. Rathbun, Olympia, Wash. Some species of fruit do not grade well in machines. The design of the present device is to dispense with the use of a grading or sizing machine, and to provide means by which the two operations of grading and packing may be combined, thus dispensing with one handling of the fruit, and avoiding the difficulties arising from unsuitable shape or constitution.

APPARATUS FOR ADMINISTERING ANESTHETICS.—Dr. M. J. Wunderlich, care G. Amsinck & Co., Box 242, New York. The apparatus illustrated herewith is simple in construction, easily sterilized and readily manipulated with one hand. It is arranged to allow gradual administering of the anesthetic to the patient, and to store the mixture of exhalations and anesthetic gas, thereby economizing the anesthetic. It comprises a funnel with absorbent material in the apex for the anes-

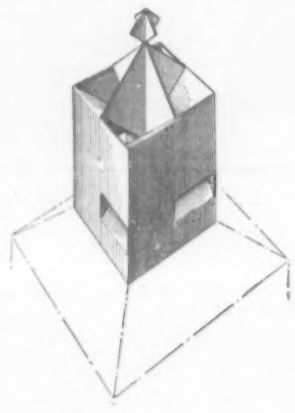


APPARATUS FOR ADMINISTERING ANESTHETICS.

thetic, a support for a receptacle containing the anesthetic, a pipe opening into the funnel apex and adapted to communicate with said receptacle to allow the liquid to flow into the absorbent material.

PERPETUAL CALENDAR.—C. D. Kendig, Lorain, Ohio. The purpose of this invention is to provide details of construction for a calendar that affords means for an adjustment of the parts which will adapt the calendar for continuous use for a long term of years and reliably exhibit the year, month, week and day in current order as time passes.

VENTILATOR.—D. H. Mowen, Hagerstown, Md. One of the chief purposes of the invention is its use as a draft creator in the case of defective or faulty flues. It may be molded of concrete or terra cotta and substituted for chimneys in the erection of new buildings, or made of sheet metal for use on chimneys and



VENTILATOR FOR FLUES.

stacks, or the ventilation of cars, outbuildings, etc. The diagonal partitions are so arranged as to preclude the possibilities of a downward or backward draft, while the upward draft is increased by the velocity of air in any direction, or the motion of the ventilator if attached to a car or other vehicle.

IGNITER.—A. DeRose, Gilroy, Cal. This invention is especially adapted for use in igniting explosive liquids secreted in holes and burrows made and inhabited by gophers and the like. The present igniter is adapted to be lowered into the gopher hole or the like, in close proximity to the explosive liquid and ignited by the operator standing outside and away from the hole.

COMPARTMENT-CASE.—C. A. Studds, Garden City, New York. This invention relates to improvements in cases adapted for use in ticket offices and the like, but more particularly to ticket cases designed for use in railway offices for holding the tickets for cars in which seat reservations are sold, as for instance, parlor cars, sleeping cars, observation cars and the like, and also for holding the car schedules or diagrams upon which a record is kept of the tickets sold for each individual seat.

TIP FOR CIGARETTES.—H. P. Strause, New York, N. Y. The inventor's particular object here is to provide a neat, efficient and inexpensive tip. Means prevent doubling of the edges and avoid necessity of any sort of projecting ends or threads, the bands being of single thickness of the material used. He preferably makes the outer jackets of ilk as poisons do not pass into the smoker's mouth quite so readily as when other fabrics are used.

Hardware and Tools.

PERMUTATION-LOCK.—J. P. Crosthwait, Sadieville, Ky. The objects in view in this instance are: to provide a lock wherein the combination may be worked by sound; to simplify and cheapen the construction; to provide a lock wherein the combination may be easily and quickly altered; to provide a lock having a combination so simple as to be easily memorized for family use, and thus obviate the need for pass keys.

SAW-HANDLE.—W. S. Locke, Lents, Ore. The handle relates more particularly to crosscut saws. To the handle bar is secured a bracket having a depending sloping member grooved at the front edge for receiving the end of the saw blade and on the depending member a stirrup-like clip is carried, and a pin extending transversely through the clip is adapted to pass through a hole in the saw blade and then by a wedging action between the clip and depending member of the handle bracket the handle is tightened against the saw blade.

VISE.—L. R. Blackmore, Arlington, N. J. In the use of pipe vises it is common in the ordinary form of pipe vise to slide the pipes longitudinally from one position to another along one of the serrated jaws of the vise. This operates to dull the teeth of the jaws and is objectionable. The inventor seeks, among other improvements, to provide means whereby the pipe is supported independently of the toothed jaw in adjusting the pipe to the desired position.

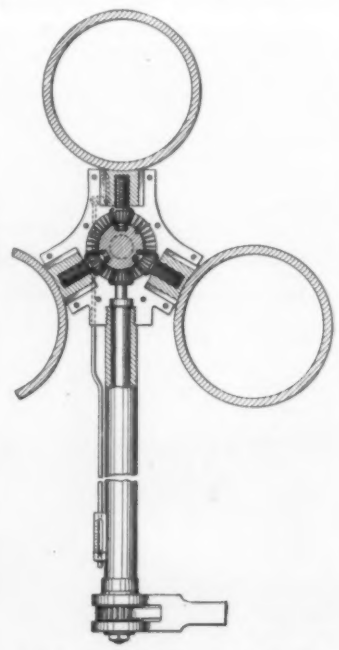
WINDOW-BRACKET.—J. H. Ashmead, Lake George, N. Y. The device is adapted especially to be formed entirely of wire, and the object of the invention is to produce a device for supporting a shade roller and a curtain pole of simple form, being light and yet having sufficient rigidity to support the shade roller and curtain pole securely.

Machines and Mechanical Devices.

PORTABLE HAND-DRIVEN TURNING-LATHE.—W. D. Verschoyle, Taurago, Sligo, Ireland. The object of the present invention is to provide means in a lathe, of the kind wherein the bed is constituted by a bar attached to an upright whose lower portion is fitted to turn in, and adapted to be fixed to a socket forming part of a clamp whereby the entire lathe may be secured to a table, for increasing the speed of, and for varying the power transmitted to, the driving spindle.

RANGE-FINDER.—D. Schneider, Dixie, Wash. In the present invention the improvement is in range finders, and the object of the inventor is to provide a device of this class, which will indicate on a dial, the angle of variation between a pair of normally parallel supports, upon each of which is rigidly mounted a telescope.

TOOL FOR SPREADING BOILER-TUBES.—A. P. Gerald, 92 Poplar Street, Jersey City, N. J. The tool illustrated herewith is adapted for spreading apart the tubes of boilers to facilitate the insertion of bricks to form a horizontal baffle or partition. The bricks are usually provided with grooves at opposite edges



TOOL FOR SPREADING BOILER TUBES.

to fit on adjacent tubes. In order to get the bricks up between the zigzag tiers of tubes, it is necessarry to spread the tubes apart horizontally and also vertically, so that the bricks may turn and be moved into the desired position.

SCAFFOLD-BRACKET.—C. C. Reeder, Lincoln, Ill. In this instance the invention is an improvement in scaffold brackets, and the purpose of the invention is the provision of a device which may be securely clamped on supports of varying thickness, and in which the scaffold supporting arm will be held at all times in horizontal position.

PERPETUAL CALENDAR.—C. E. Boillot, New York, N. Y. This invention is adapted to be controlled by a clock or any other source. An object is to provide a device which will automatically control the displaying of the days of the month for months of different length, and includes means for controlling the exhibition of twenty-eight and twenty-nine, during February, in the proper years.

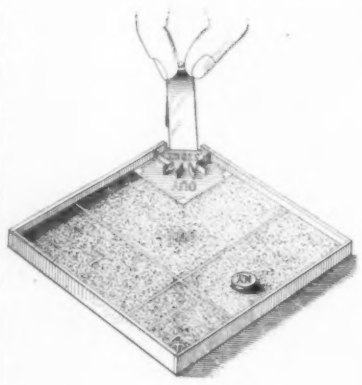
TESTING-MACHINE.—J. W. Carter, Manila, Philippine Islands. In this patent the invention has reference to testing machines, more particularly to that class of testing apparatus for determining the power of a blow, and has for its object the provision of an apparatus for estimating the force of a blow delivered with the hand or the foot.

Railways and Their Accessories.

CAR-FENDER.—G. Hipwood, New York, N. Y. This fender is an improvement in those of the character shown in a former patent granted to Mr. Hipwood, wherein the fender is made up of a horizontally-extending main fender, a vertically-extending supplemental fender pivoted to the main fender to fold thereon, and a track arranged under the car on which the fender is supported and adapted to be shifted to a removed position when the two portions of the fender are folded together.

Pertaining to Recreation.

GAME APPARATUS.—Albert J. Krug, 443 Texas Street, San Francisco, Cal. The apparatus consists of an inexpensive device which may be played by one or more persons, and which involves the principles of the game of baseball. At one corner of the board is a chute down which a marble may be rolled. The



GAME APPARATUS FOR BASEBALL.

marble is required to pass through a barrier, and if it fails to do this the throw counts as a strike. If it stops in the area marked "out," this eliminates the player temporarily. If it stops in the numbered areas the value of the throw is indicated by the numbers.

Pertaining to Vehicles.

VEHICLE-WHEEL.—L. G. Fleming, Tarrytown, N. Y. The object here is to provide a wheel arranged to readily absorb shocks by the use of a yielding suspension between the center and the tire of the wheel, at the same time providing the desired rigidity in a transverse direction as well as in the line of travel of the vehicle, either forward or backward, to prevent wabbling of the automobile or other power-driven vehicle wheel.

Designs.

DESIGN FOR A REFRIGERATOR.—J. Colonel, New York, N. Y. This ornamental design for a refrigerator is that of a receptacle rather higher than ordinary but of very attractive proportions. The panel effect is marked, yet in harmony with the ornaments which comprise carved columns on the front extremes and which are bent at the top to cross the face of the refrigerator. These columns terminate in claws holding castors.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

Replanning Reading. An Industrial City of 100,000. By John Nolan. Boston: George H. Ellis Company, printers, 1910.

The city of Reading celebrated its sesquicentennial in 1898. It did not, however, grow casually without direction, like so many old towns, but was definitely planned in the beginning, and its present plan is merely a mechanical extension of the original. The first town plan of Reading was made in 1748 by Nicholas Scull, the surveyor-general of Thomas and Richard Penn, who were the sons of William Penn. It provided for two main streets of extra width at right angles to each other, a central square, and a location of some distinction for the court house, the only public building at the time, and for the markets. The unyielding and ugly rectangular system of streets which is so characteristic of Philadelphia was reproduced at Reading, notwithstanding the fact that, while the site of Philadelphia is comparatively flat, that of Reading is hilly with surroundings that warrant the term mountainous. But the admirable feature of open green squares at regular intervals which Penn provided for Philadelphia is altogether lacking in the plan for Reading. The object of the present volume is to present an elaborate scheme for the remaking of Reading, which

shows remarkable ability, and if carried out will tend to make it a more important center than it is at present. The book is accompanied by maps, and there is an interesting bibliography of books on civic improvement.

HOW TO READ CHARACTER IN HANDWRITING. A Guide for the Beginner and Student in Graphology. By Mary H. Booth. Philadelphia: The John C. Winston Company, 1910. 18mo.; 72 pp. Price in boards, 35 cents.

Since the earliest days science has recognized the fact that handwriting is an index of character and placed reliance on deductions from it. Criminals have been punished and accused men set free on the strength of a scrap of handwriting. Knowledge of this interesting science is imparted in a simple but thorough manner in this new work by a recognized expert, and will prove of great value not only as a source of entertainment but to business men, lawyers, students, bankers and collectors of autographs. It is authoritative and interesting and so popular as to appeal to everyone.

SCIENCE FROM AN EASY-CHAIR. By Sir Ray Lankester. London: Methuen & Co. 16mo.; 423 pp.

The volume before us consists of about forty-three essays written in a popular style on the most diverse scientific subjects. The range includes the Darwinian theory, freshwater jelly fishes, the heart's beat, protoplasm, cholera, oxygen gas for athletes and others, cave men's skulls, etc. Coming, as it does, from one of the most distinguished of British biologists, and written in so simple a vein that any intelligent reader can understand the argument, the book is indeed an exceptional work of its kind.

TRANSPORTATION IN EUROPE. By Logan G. McPherson. New York: Henry Holt & Co., 1910. 12mo. Price, $1.50 net.

Just after completing a three years' first-hand study of the traffic conditions of the United States, Mr. McPherson accompanied the National Waterways Commission to Europe for a similar investigation on the Continent and in England. This volume is the result. In the main it is a rearrangement and amplification of the author's formal reports to the National Waterways Commission, each of which received the critical scrutiny of cabinet ministers and other officials charged with the control of the ways of communication in the several countries of Europe, as well as leading men of affairs. The author is Lecturer on Transportation at the Johns Hopkins University, and is the author of "The Working of the Railronds"; "Railroad Freight Rates in Relation to the Industry and Commerce of the United States," etc.

SOLENOIDS, ELECTROMAGNETS, AND ELECTROMAGNETIC WINDINGS. By Charles R. Underhill. New York: D. Van Nostrand Company, 1910. 12mo.; 342 pp. Price, $2 net.

Since nearly all of the phenomena met with in electrical engineering in connection with the relations between electricity and magnetism are involved in the action of electromagnets, it is readily recognized that a careful study of this branch of design is necessary in order to predetermine any specific action. With the rapid development of remote electrical control, and kindred electromechanical devices wherein the electromagnet is the basis of the system, the want of accurate data regarding the design of electromagnets has long been felt. With a view to expanding the knowledge regarding the action of solenoids and electromagnets, the author made numerous tests covering a long period, by means of which data he has deduced laws, some of which have been published in the form of articles which appeared in the technical journals. In this volume the author has endeavored to describe the evolution of the solenoid and various other types of electromagnets in as perfectly connected a manner as possible.

PRACTICAL BUNGALOWS OF SOUTHERN CALIFORNIA BUILT AT MODERATE PRICES. Los Angeles: Los Angeles Investment Company, 1910. Oblong quarto; 128 pp. Price, 50 cents.

The types of bungalows which are reproduced are excellent and the number of illustrations is considerable, and the plans which are reproduced with them are on a good scale. The book is worthy of a considerable sale.

A MANUAL FOR ASSAYERS AND CHEMISTS. By W. H. Seamon, B.S.A. New York: John Wiley & Sons. 12mo.; 255 pp. Price, $2.50 net.

In this book the author has crystallized his experience of fourteen years as a teacher of chemistry and assaying in technical schools, and fifteen years of practical work in the mining districts of the Southwest, including Mexico. He writes principally for the young graduate of the mining school thrown upon his own resources for the first time, and brought face to face with conditions and problems unknown to the schools, which he can only solve after years of experience, unless he is given the experience of those who have preceded him. The author only gives those methods which he has used with satisfactory results. Many of the methods are original, and appear for the first time in book form. Technical methods are still in a condition of evolution, so that some of those given are not in accord with the latest conventional ideas. The impression prevails that the results reported by technical analysis are less accurate and reliable than those reported by so-called scientific analysis, but technical methods must be quick and the results must be as near to accurate as it is possible to attain. The book is an excellent one.

WORK, WAGES, AND PROFITS. Their Influence on the Cost of Living. By H. L. Gantt. New York: The Engineering Magazine, 1910. 16mo.; 194 pp.

This is a reissue in book form of the series of articles on "The Compensation of Workmen and Efficiency of Operation," which appeared in The Engineering Magazine, February to June, 1910. With these are combined three of Mr. Gantt's most important preceding contributions, thoroughly revised, adapted, and brought up to date. The book as a whole is the most complete statement of Mr. Gantt's philosophy and methods that has yet been put forth. In the last chapter especially he shows clearly and forcibly its foundational and vital connection with modern industrial conditions, and he offers thoughtful conclusions which might well affect our economic and industrial policy for the future.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of June 18th, 1910, or will be sent by mail on request.

(12284) E. T. writes: S maintains that a free falling body attains the utmost speed of which it is capable by the attraction of gravity, therefore that if a man was standing on some falling body (and allowing that he could maintain his equilibrium) he would be unable to jump up, as to do so he would have first to bend his knees and lower his upper body, which would be impossible, as the body traveling at the highest speed possible would be unable to bend, as bending is simply removing a support, and the lowering of the body is simply due to gravity, which is already exerting its utmost effort on the body and therefore cannot possibly increase its efforts, and that in like manner the sand in an hour glass could not fall nor could water be drunk from a cup. T maintains that gravity is acting on the falling body (fulcrum) on the man, or the hour glass, and on the cup as a falling mass, that their relationship as one falling body exists only provided no other power interferes, that if human or mechanical interference occurs, their relationship to gravity is changed. If the man drinks water, the liquid will go down his throat by the attraction of gravity. If he places the hour glass in proper position the sand will run, and that he himself can jump up and come down to his base, same as on *terra firma;* in short, that gravity will exert itself on the falling mass as a whole plus the exertion on separate parts, as soon as their relation to their base is interfered with in such manner as to deprive them of their previous support. A. A freely falling body is at any moment moving with the utmost speed of which it is capable at the place where it is. There can be no doubt of that. The moon is falling toward the earth, and the earth and moon together are falling toward the sun with the highest velocity possible at their distance from the sun and the mass of the sun being what it is. Now such a motion does not alter the fact of the gravitation of two such masses toward each other as they fall toward the center of their attraction. And if this mutual attraction is sufficient, as it is in the case of a man on the earth, he may jump about as we do, because he can react against the attraction of the earth for him. But if the two falling bodies were very small, very much action of one against the other would not be possible, and muscular action would not call forth much reaction. Thus, if a man were on a globe of small mass or weight, and he should make an effort to jump up, he would simpy kick himself and the globe away from each other. We cannot agree with your statement that a body moving at its highest speed cannot bend. Gravity does assist in bending any portion of the body downward, but it resists bending upward, and we do raise and bend the legs, arms, and head upward. Lying down, we can bend upward. Of course this implies sufficient gravitation to furnish a base against which reaction may be exerted. Bending is simply a muscular action internal to the mechanism of our bodies. A single person in space, alone, either free or falling toward some center of attraction, the earth for example, could bend himself, move a leg or arm, etc., with the same ease as now, but if he does, he will cause some other part to move oppositely with reference to the center of gravity of his body, that is, his action will produce an equal and opposite reaction with reference to his center of gravity. So too a man falling could produce a motion of his muscles within himself as easily as if he were at rest, as one may prove by hanging head downward and swallowing water or any solid food upward. True, sand could not run out of a glass which was moving with the maximum possible velocity attainable under the maximum force of gravitation in the universe. This means simply that if glass and sand were moving together as fast as they could possibly move, under the action of all the gravitation in the universe, the sand in the glass could not be made to move any faster. It is not necessary to say that this statement is simply a logical one. Sand is absolutely inert. If sand is going as fast as it can, it cannot go any faster in the same direction. If the only force acting on sand is moving it with a certain velocity, it cannot move any faster than it is moving. This is a true statement, but we fail to discern its value. We cannot agree with the statement that swallowing is due to gravity. As we have said, one may swallow upward. Anyone may demonstrate this for himself. The flow of the blood from the heart up to the top of the head is against gravity, and is due to the muscular action of the heart and the resiliency of the coats of the arteries. We cannot agree with the statement that gravity can act upon the parts of a mass in addition to its action upon the mass as a whole. We would say also that a man on a freely falling body at maximum speed and of a mass no greater than that of the man, would have no equilibrium at all, excepting with reference to his own center of gravity. He would be practically an independent body, since the gravitation of a mass as small as that of a man is practically zero. Finally, we find ourselves more nearly in agreement with S than with T.

Legal Notices

PATENTS

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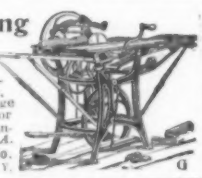

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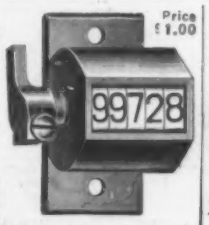

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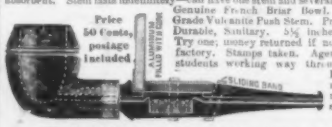

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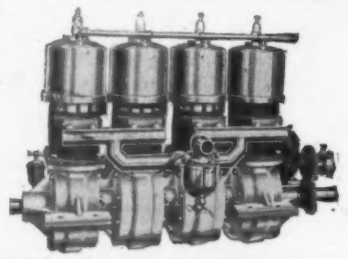

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